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THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

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DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

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G. WARREN DRESSER, Editor,

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☞ An asterisk (*) denotes an illustrated article

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WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit Correspondence for publication from all among them who make the study of these subjects a pleasure, or a profession.

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SIXTH ANNUAL MEETING OF THE AMER. GAS-LIGHT ASSOCIATION.

OFFICE OF AMERICAN GAS-LIGHT ASSOCIATION,
150 BROADWAY, N. Y. CITY.

The Sixth Annual Meeting of the American Gas Light Association will be held in the city of New York, on the 16th, 17th, and 18th days of October, 1878. The Meetings will commence at 10 o'clock, A.M., on the 16th. Headquarters will be at the Fifth Avenue Hotel, corner of 23d Street and Fifth Avenue. The place of meeting has not yet been definitely fixed, but will be at the Fifth Avenue Hotel, if a suitable room can be obtained. There will be a meeting of the Executive Committee of the Association at the Fifth Avenue Hotel, on the evening of the 15th of October, at 8 o'clock.

Members of the Association are reminded that this meeting is to be continued through three days, so that ample time will be had to discuss the topics and papers presented to the meeting.

Members are earnestly requested to prepare papers, in their own way, on such topics as they would like to learn about, and bring them before the meeting for friendly discussion.

A meeting, large in numbers, is anticipated, full of interest, and of real value to every gas engineer and gas maker in America.

SEC. IV. of the Constitution gives the qualifications for membership, and reads as follows:

"To be eligible as an active member, a person must be a president, vice-president, director, secretary, treasurer, engineer, consulting engineer, or superintendent of a gas company, or an individual manager of a gas works, or a person practically skilled in the construction and management of gas works."

All persons eligible for membership, as above, are respectfully invited to become members of the Association, and, by so doing, benefit themselves and the gas fraternity generally.

CHARLES NETTLETON,
Secretary.

THE ELECTRIC LIGHT.

"The vestry of Chelsea have sent their surveyor, Mr. G. H. Stayton, to Paris, to inspect the system now being tried there for employing the electric light in lieu of gas for street-lighting. He reports that the distance between the lamps in Chelsea being much greater than in Paris, and their being only one lamp on each column, greatly increases the comparative cost of the systems. The present cost of a gas lamp in Chelsea, burning 3,580 hours per annum, is £3 6s. 7d., therefore, the expense of the forty in Sloane Street is 8¼d. per hour. To light the Chelsea Embankment, which is about 1,530 yards long, and has 109 gas lamps, including those on the river wall, belonging to the Metropolitan Board of Works, would require *a first outlay of* £4,800 *for forty-eight lights* of 3,250 hours per annum, *with an hourly cost of* £1 4*s*. *The present cost of the gas lamps is* 2*s*. 1½*d*. *per hour*, for 3,850 hours per annum. After a careful consideration of the whole question, Mr. Stayton says: 'I am of opinion that at present the electric light is not suitable for street lighting in the metropolis; that it is suitable and can be utilised with splendid effect in large squares and places such as Trafalgar Square and Parliament square; but, although in each of these places at the present time the lamps are numerous the cost would be greater than gas. I am also of opinion that, so soon as the modifications alluded to can be effected (particularly as to the electric current being carried to a much greater distance, thereby reducing the cost), the electric light will very soon supersede gas to a considerable extent, its attendant advantages being so great."

The argument of the learned surveyor, as to the future state of street-lighting, is sound, no doubt; but it seems as though it might have been worded in something like the following form:

"When electricity can supersede gas as a means of illumination, both in price and quality of light, it will probably be adopted."

The surveyor of Chelsea has struck on one of the main troubles in all the the attempts thus far made at electric lighting, viz.: The trouble experienced in conveying the necessary currents for any great distance. If Niagara could be utilised for power, to run vast electro-magnetic machines, the transmission of the electricity generated would be the question yet to be solved. In Paris the cables for the electric light are not usually over *one hundred and fifty yards* in length, although it is claimed that they *may* be *six hundred*. It works much more satisfactorily when the distance is short; but this necessitates *power* at frequent intervals.

The best power yet found for giving a steady electric light is the gas engine, as recently improved; and we are credibly informed that the Jablochkoff lights, on the Opera House in Paris, are actually supplied with their electric currents from machines driven by a gas engine. The cost

of street lighting, by this system, in Paris is from three to four times as expensive as gas for the time they are employed. The electric lights are all put out at 12 o'clock at night, and the gas is turned on till morning.

The electric light has undoubtedly a future and a wide field for usefulness in connection with, and assisted by, gas. There should be no conflict or opposition between them; but it is useless to expect either system to accomplish impossibilities. The time has not yet arrived when anything of value can be legitimately obtained without paying therefor, and that, too, at about the market price. As electric lighting stands today it is expensive and not sufficiently divisible; but, after what has been found out in electric science during the last few years, it would be folly to attempt prophesy as to the future.

Nor is it necessary. There are today enough uses to which the light may be applied, to develop its capabilities; and we shall be very glad to lay before our readers, from time to time, all the reliable information to be obtained bearing upon this subject.

We would not advise that anyone allow his works to run down or deteriorate in the least on the ground that the gas business will soon be over. This is not the case. All that will be required in the future will be to reduce the price as low as possible, and do all that can be done to increase consumption by day as well as by night, and "borrow no trouble" about the electric or any other light.

A NEW SYSTEM OF CHARGING RETORTS.

At our request the President of the Yonkers Gas-Light Company has sent us the following report of the results obtained at their works, during the last nine months, through working under a new system of charging the retorts.

As the yields seem to be much larger than those usually obtained from the ordinary coals, we think that the gas companies should look into the matter and give the new system a fair trial.

OFFICE YONKERS GAS-LIGHT CO,,
YONKERS, N. Y., 4th Sept., 1878

Dear Sir: I have your inquiry about our method of charging retorts, and reply as follows:

We use benches of fives, and light from two to four or more benches at once according to the season. The retorts are 14″ × 22″ × 9 feet, inside dimensions. Our charges have been uniformly 200 lbs. to a retort every five hours.

Our fire chambers are rather small, preventing very high heats and keeping down the yield, but we get good illuminating power, usually from 16 to 18 candles, from Penn or similar coals, with no enricher. Our new fireplaces we are making larger.

Previously to last February we charged all five retorts of each bench together in the usual way.

Since 7th February, 1878, only one retort in each bench is charged at one time, and that one as near as possible to the retorts that have been longest charged; the hour after another retort is charged, on the same principle, and so on, at hourly intervals, so that it is five hours before all the retorts of the bench are renewed. The object of this method is to keep the heats at a uniform height, and sufficiently high to generate gas to the best advantage. By the ordinary method half a ton, or more, of coal just from the shed, is thrown into one bench, over one fire, and unavoidably reduces the heats very materially, and that, too, at the critical half hour or hour when the greatest production is making. But 200 lbs., or even 250 lbs. at a time, in one retort of the bench, all the other retorts being full of red hot coal, has but a slight effect in reducing heats It is not the average temperature of the bench, but the uniformly high temperature, especially immediately after charging, which counts in yield and in quality. The actual result in our works, has been a gain of about one foot of gas in the pound of coal, as is shown in the tabular statement below.

In July we went back for three or four days to the old method of charging all five retorts of a bench at once, and the yield immediately fell back to 4·44 per lb. On resuming the single retort charges the yield went up again to 5·40, but the average of the month was reduced by the experiment.

This table shows that the results were much better during the last seven months than those obtained during the months of December and January.

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We will now compare the yields obtained, during the last seven months, under the new system, with that obtained for the month of December, under the old system, and give the rate of increase for each month.

Month.	Kind of coal.	Pounds of coal.	Cubic feet of gas made	Yield, Pounds.	Candles.	Unaccounted for Gas.
Dec. 1877.....	Westmoreland. 5 % Ince Hall.	749,300	3,315,600	4.42	16 — 18	about 15%
Jan. 1878.....	Clover Hill. " "	737,800	3,328,790	4.51	16 — 18	"
Feb. 1878.....	Kanawha. Clover Hill.	535,600	2,629,440	4.90	16½—	"
Mar. 1878.....	New Pelton. " "	478,400	2,543,680	5.32	16½— 17	357,477 ft.
April 1878.....	Clover Hill alone.	385,700	2,021,560	5.24	16½— 17	246 065 ft.
May 1878.....	C. H. and Despard.	325,900	1,787 790	5.485	16½— 19	278,455 ft.
June 1878.....	" "	291,600	1,609,140	5.518	16½— 19	257,868 ft.
July 1878.....	Clover Hill and 2 % Ince Hall.	282,800	1,474,120	5.210	16½— 19	about 14%
Aug. 1878.....	Despard.	323,300	1,801,200	5.590	16½— 20	"

I am not able to give the proportion of each coal, when different kinds were used, and I hardly think it material.

Yours very truly,
THOS. C. CORNELL,
President.

We notice that the charges (200 lbs.) are rather small for retorts 14″ × 22″ × 9′, and five hour charges, and that the average yield of gas per retort per 24 hours, for the month of August, was only 5,366·4 cubic feet, and per bench 26,832 cubic feet.

Nothing less than 6,000 cubic feet should be accepted from a retort of that size, and 30,000 cubic feet from a bench of fives.

We think that they may easily do that, and get their extra yields as well, if they will only try.

We certainly should expect that such a system of charging would produce much better results than those obtained from the ordinary charging, because the single charge cannot possibly lower the temperature of the retort and oven as much as when the whole of the retorts are charged at the same time; and because the temperature of the oven is consquently kept up to the highest degree, at the most important time, after the charge is put in the retort.

We will now give a table of their yields, reduced to candle feet, for the purpose of comparison:

		Yield per lb.		Candle power.		Candle feet.
Dec.,	1877	4·42	×	16·00	=	70·72
Jan.,	1878	4·51	×	16·00	=	72·16
Feb.,	1878	4·90	×	16·50	=	80 85
Mar.,	1878	5·32	×	16·50	=	87·78
April,	1878	5·24	×	16·50	=	86·46
May,	1878	5·485	×	16·50	=	90·50
June,	1878	5·518	×	16·50	=	91·04
July,	1878	5·21	×	16·50	=	85·96
Aug.,	1878	5·59	×	16·50	=	92·23

Feb., 1878—
$$\frac{(80{\cdot}85 - 70{\cdot}72) \times 100}{70{\cdot}72} = 14{\cdot}3 \text{ per cent increase.}$$

March, 1878—
$$\frac{(87{\cdot}78 - 70{\cdot}72) \times 100}{70{\cdot}72} = 24{\cdot}1 \text{ per cent increase.}$$

April, 1878—
$$\frac{(86{\cdot}46 - 70{\cdot}72) \times 100}{70{\cdot}72} = 22{\cdot}2 \text{ per cent increase.}$$

May, 1878—
$$\frac{(90{\cdot}50 - 70{\cdot}72) \times 100}{70{\cdot}72} = 27{\cdot}9 \text{ per cent increase.}$$

June, 1878—
$$\frac{(91{\cdot}04 - 70{\cdot}72) \times 100}{70{\cdot}72} = 28{\cdot}7 \text{ per cent increase.}$$

July, 1878—
$$\frac{(85{\cdot}96 - 70{\cdot}72) \times 100}{70{\cdot}72} = 21{\cdot}5 \text{ per cent increase.}$$

August, 1878—
$$\frac{(92{\cdot}23 - 70{\cdot}72) \times 100}{70{\cdot}72} = 30{\cdot}4 \text{ per cent increase.}$$

This shows that the yield for the month of August was 30·4 per cent. higher than that obtained for the month of December, 1877.

If such results as these can be obtained from the ordinary coal, the new system of charging retorts will be very acceptable to gas companies at the present time.

GAS MOTORS.

A description of gas motors is given on another page of this issue.

There is nothing in the way now to prevent these useful little engines from coming into general use, if the business is properly pushed.

We have been informed that three of the Otto

and Laugen motors have been in use at Derby, Connecticut, for a considerable time, and that they are giving the most perfect satisfaction to the owners and gas company; that the expenditure of gas is from 23 to 26 cubic feet, per horse power per hour; that it only requires 15 seconds to start and get the engine up to full speed; and, consequently, it does not require the usual fixed and loose pulley arrangement for starting and stopping the machinery which it drives.

We believe that there are three sizes of these motors generally made, viz., of two, four, and seven horse power.

These engines are now coming into general use in Europe, and we hope that they will soon take in this country, for gas ought to be quite cheap enough for the purpose.

DEATH OF E. M. PERKINS.

Since our last issue the JOURNAL has met with a loss which, though perhaps not of most importance to our readers, is a very serious one to us. Mr. E. M. Perkins has been a faithful and hard working servant of the JOURNAL for nearly 14 years; and, to those who have been familiar with the office workings of the paper, he was well known. A true and faithful servant never passes away without leaving a shade of sorrow to those who are left, and in the loss of Mr. Perkins the JOURNAL has been bereft of one of those who could almost speak from the beginning.

Peace to his ashes! May he meet with the reward due those who have always labored for the advancement of their fellows.

Providence Gas Company.

IMPORTANT MEETING YESTERDAY.—THE CITIZENS GAS-LIGHT COMPANY TO BE ABSORBED.

An important meeting of the Providence gas company was held on Monday, September 2d, in the office of the company, rear of the What Cheer Building. It was both an annual meeting and a special meeting, the subject of special action being the proposed purchase of the property of the Citizens gas-light company, and matters connected therewith. The attendance was large, and a vast majority or the stock was represented.

Mr. A. B. Slater, Treasurer, read the records of the last annual meeting, and of a special meeting, which was held August 16th. The records of the special meeting included a statement of the directors with reference to an agreement to purchase the property of the Citizens gas-light company. The statement set forth that the Citizens gas-light company claim that their works are capable of producing more than 600,000 cubic feet of gas daily, and of furnishing storage for the same. The property is to be delivered free of debt and incumbrance, and includes twenty miles of mains, laid through the most compact part of the city. Although the Providence gas-light company did not fear the competition, there was still an amount of friction by no means comfortable. The Citizens company had asked for an agreement by which they should have control of a district equal to one-third of the city. As our company's capital was large and we had pipes in all parts of the city, we could not consider the question of a division of territory. The directors did not feel at liberty to exhaust the company, and hence the agreement was made. The directors regret the necessity of this arrangement, which will be somewhat costly to the stockholders, but no other course so wise seemed open to them. The company had contested the ground most successfully, inch by inch, in a fair competition, but when the future promised little more than a mere struggle for the mastery, a test of endurance without any promise of profit, even to the community, it declined the contest, if it could be avoided on any decent terms. Although there is no immediate necessity for the enlargement of its works, the company can soon utilize the property which it is proposed to purchase. Mr. Barstow read this statement for the benefit of those not present at the last meeting.

Mr. Slater, for the same object, read agreement to purchase the Citizens gas-light company. It was dated Saratoga, July 31st. The signers were a committee of the directors of the Providence gas-light company, and C. K. Garrison and John P. Kennedy, representing the Citizens company. The stipulation was for the payment of $100,000 to the Citizens company, and the transfer of eight thousand shares of the Providence company's stock to said company.

After the approval of the records, Mr. Barstow presented the annual report of the Board of Directors. It commences with paying a graceful tribute of esteem to the late Truman Beckwith, who was a director from the organization of the company. Statements are then made relative to the work of the year. The company has extended its pipes about eight and a-half miles, making the present length one hundred and twenty miles. Five miles of this extension are embraced in the lines to Pawtuxet and the State Farm. The outlays for enlargements and improvements during the year were moderate. Notwithstanding the competition of the Citizens company the number of metres had been increased, and there were at the end of the year a total number of 9,968, the largest number ever reported.

The report then goes on to give some statements with reference to the new works. If there is an increase of business, such as the company experienced for five years after the completion of the west side works, it continues, the property which it is proposed to purchase will be found very useful and may arrest the necessity for large expenditure. The increase of capital stock necessary for making the purchase will necessitate a slight increase in the present low price for gas, but the price will still be low—lower than the figures of any of the gas companies on our seaboard. The returns of the company for the first six months of this present year show a production of four millions of cubic feet more gas than for the corresponding months last year.

The report concludes as follows:

In conclusion, the Board congratulate the corporation that in passing through a period of unexampled commercial embarrassment and distress, as well as of a well-organized and strong business competition; though losses have occurred, dividends been reduced and the market value of our stock much impaired, we come to this annual meeting without debt. We are able, also, to report an unusually large stock of coal in our sheds all paid for. Having money on hand, the very low price of freight induced us to fill our sheds early in the season, and also to keep those at the west station pretty well filled, so that now we have more than 17,000 tons of coal on hand. We shall incur some debt in our settlement with the Citizens gas-light company, but as money is plenty, and the rate of interest low, we do not think it advisable to recommend the issue of more stock. After this settlement our capital stock will stand at $2,500,000, an amount quite large enough for the amount of business we are now doing.

The report was received and ordered placed on file.

It was voted to proceed to the special business of the meeting, and a resolution was introduced withdrawing certain restrictions upon the issue of stock, imposed by vote September 9th, 1872, so far as to authorize the Board to issue 8,000 shares to representatives of the Citizens gas-light company.

To carry this resolution a majority of the capital stock of the company was necessary, and the voting involved the necessity of calling over a list of five hundred names. About an hour was occupied in checking the votes. About three hundred stockholders were represented in person or by proxy, and only one, a gentleman representing forty-nine shares, said "nay" to the proposition.

The business of the annual session was then resumed.

The old Board of Directors, as follows, was re-elected: Wm. Goddard, Wm. Whitaker, Amos C. Barstow, Charles E. Paine, A. B Slater, Royal C. Taft, Edward Pearce, Jr., Jesse Metcalf, Amos N. Beckwith.

It was voted to print copies of the report of the Board of Directors, or such portion thereof as the Directors deem expedient for the use of the stockholders.

Adjourned.

At a meeting of the Board of Directors held immediately after the adjournment, the following officers were elected:

President—Hon. Amos C. Barstow.
Vice President—William Goddard.
Sec. and Treas.—A. B. Slater.
—*Providence Journal.*

The Providence gas company, at its recent meeting, adopted by an almost unanimous vote, the proposition to purchase the property and franchises of the Citizens gas-light company, and the arrangement was subsequently consummated, so that now the gas supply of the city is again under one control. The consideration paid for the property, which cost the Citizens company, it is understood, something more than $700,000, is $100,000 in cash, and $400,000 in stock at par. Notwithstanding the natural distrust of what are styled "monopolies," this consolidation, we are inclined to think, may prove the best for consumers as well as stockholders. The competing company had commenced a contract to supply gas to large consumers at a price confessedly below the cost of manufacture. A course of competition of this kind would have rapidly wasted the resources of both companies, a waste which would ultimately have to be made good by excessive taxes upon consumers. This seasonable consolidation prevents any such exhaustion, and the old company will need to make no large advance on its competitive rates to earn a fair dividend. We suppose that we consumers must look for a little higher price, but the character of the managers, no less than the moderate cost of other illuminating material, will be a satisfactory guarantee against any unreasonable advance. Probably the price of gas hereafter will be about $2 25 per thousand feet, instead of $2 00, the price that has been charged since the companies entered into active competition for the field.—*Ibid.*

THE CITIZEN'S GAS COMPANY of Frederick, Md., has commenced the erection of works to supply that city with petroleum gas. It is expected that the new gas will be supplied to customers about the 1st of November.

of street lighting, by this system, in Paris is from three to four times as expensive as gas for the time they are employed. The electric lights are all put out at 12 o'clock at night, and the gas is turned on till morning.

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A NEW SYSTEM OF CHARGING RETORTS.

At our request the President of the Yonkers Gas-Light Company has sent us the following report of the results obtained at their works, during the last nine months, through working under a new system of charging the retorts.

As the yields seem to be much larger than those usually obtained from the ordinary coals, we think that the gas companies should look into the matter and give the new system a fair trial.

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Nothing less than 6,000 cubic feet should be accepted from a retort of that size, and 30,000 cubic feet from a bench of fives.

We think that they may easily do that, and get their extra yields as well, if they will only try.

We certainly should expect that such a system of charging would produce much better results than those obtained from the ordinary charging, because the single charge cannot possibly lower the temperature of the retort and oven as much as when the whole of the retorts are charged at the same time; and because the temperature of the oven is consquently kept up to the highest degree, at the most important time, after the charge is put in the retort.

We will now give a table of their yields, reduced to candle feet, for the purpose of comparison:

		Yield per lb.		Candle power.		Candle feet.
Dec.,	1877	4·42	×	16·00	=	70·72
Jan.,	1878	4·51	×	16·00	=	72·16
Feb.,	1878	4·90	×	16·50	=	80 85
Mar.,	1878	5·32	×	16·50	=	87·78
April,	1878	5·24	×	16·50	=	86·46
May,	1878	5·485	×	16·50	=	90·50
June,	1878	5·518	×	16·50	=	91·04
July,	1878	5·21	×	16·50	=	85·96
Aug.,	1878	5·59	×	16·50	=	92·23

Feb., 1878—
$$\frac{(80{\cdot}85-70{\cdot}72)\times 100}{70{\cdot}72}=14{\cdot}3 \text{ per cent increase.}$$
March, 1878—
$$\frac{(87{\cdot}78-70{\cdot}72)\times 100}{70{\cdot}72}=24{\cdot}1 \text{ per cent increase.}$$
April, 1878—
$$\frac{(86{\cdot}46-70{\cdot}72)\times 100}{70{\cdot}72}=22{\cdot}2 \text{ per cent increase.}$$
May, 1878—
$$\frac{(90{\cdot}50-70{\cdot}72)\times 100}{70{\cdot}72}=27{\cdot}9 \text{ per cent increase.}$$
June, 1878—
$$\frac{(91{\cdot}04-70{\cdot}72)\times 100}{70{\cdot}72}=28{\cdot}7 \text{ per cent increase.}$$
July, 1878—
$$\frac{(85{\cdot}96-70{\cdot}72)\times 100}{70{\cdot}72}=21{\cdot}5 \text{ per cent increase.}$$
August, 1878—
$$\frac{(92{\cdot}23-70{\cdot}72)\times 100}{70{\cdot}72}=30{\cdot}4 \text{ per cent increase.}$$

This shows that the yield for the month of August was 30·4 per cent. higher than that obtained for the month of December, 1877.

If such results as these can be obtained from the ordinary coal, the new system of charging retorts will be very acceptable to gas companies at the present time.

GAS MOTORS.

A description of gas motors is given on another page of this issue.

There is nothing in the way now to prevent these useful little engines from coming into general use, if the business is properly pushed.

We have been informed that three of the Otto

and Laugen motors have been in use at Derby, Connecticut, for a considerable time, and that they are giving the most perfect satisfaction to the owners and gas company; that the expenditure of gas is from 23 to 26 cubic feet, per horse power per hour; that it only requires 15 seconds to start and get the engine up to full speed; and, consequently, it does not require the usual fixed and loose pulley arrangement for starting and stopping the machinery which it drives.

We believe that there are three sizes of these motors generally made, viz., of two, four, and seven horse power.

These engines are now coming into general use in Europe, and we hope that they will soon take in this country, for gas ought to be quite cheap enough for the purpose.

DEATH OF E. M. PERKINS.

Since our last issue the JOURNAL has met with a loss which, though perhaps not of most importance to our readers, is a very serious one to us. Mr. E. M. Perkins has been a faithful and hard working servant of the JOURNAL for nearly 14 years; and, to those who have been familiar with the office workings of the paper, he was well known. A true and faithful servant never passes away without leaving a shade of sorrow to those who are left, and in the loss of Mr. Perkins the JOURNAL has been bereft of one of those who could almost speak from the beginning.

Peace to his ashes! May he meet with the reward due those who have always labored for the advancement of their fellows.

Providence Gas Company.

IMPORTANT MEETING YESTERDAY.—THE CITIZENS GAS-LIGHT COMPANY TO BE ABSORBED.

An important meeting of the Providence gas company was held on Monday, September 2d, in the office of the company, rear of the What Cheer Building. It was both an annual meeting and a special meeting, the subject of special action being the proposed purchase of the property of the Citizens gas-light company, and matters connected therewith. The attendance was large, and a vast majority or the stock was represented.

Mr. A. B. Slater, Treasurer, read the records of the last annual meeting, and of a special meeting, which was held August 16th. The records of the special meeting included a statement of the directors with reference to an agreement to purchase the property of the Citizens gas-light company. The statement set forth that the Citizens gas-light company claim that their works are capable of producing more than 600,000 cubic feet of gas daily, and of furnishing storage for the same. The property is to be delivered free of debt and incumbrance, and includes twenty miles of mains, laid through the most compact part of the city. Although the Providence gas-light company did not fear the competition, there was still an amount of friction by no means comfortable. The Citizens company had asked for an agreement by which they should have control of a district equal to one-third of the city. As our company's capital was large and we had pipes in all parts of the city, we could not consider the question of a division of territory. The directors did not feel at liberty to exhaust the company, and hence the agreement was made. The directors regret the necessity of this arrangement, which will be somewhat costly to the stockholders, but no other course so wise seemed open to them. The company had contested the ground most successfully, inch by inch, in a fair competition, but when the future promised little more than a mere struggle for the mastery, a test of endurance without any promise of profit, even to the community, it declined the contest, if it could be avoided on any decent terms. Although there is no immediate necessity for the enlargement of its works, the company can soon utilize the property which it is proposed to purchase. Mr. Barstow read this statement for the benefit of those not present at the last meeting.

Mr. Slater, for the same object, read agreement to purchase the Citizens gas-light company. It was dated Saratoga, July 31st. The signers were a committee of the directors of the Providence gas-light company, and C. K. Garrison and John P. Kennedy, representing the Citizens company. The stipulation was for the payment of $100,000 to the Citizens company, and the transfer of eight thousand shares of the Providence company's stock to said company.

After the approval of the records, Mr. Barstow presented the annual report of the Board of Directors. It commences with paying a graceful tribute of esteem to the late Truman Beckwith, who was a director from the organization of the company. Statements are then made relative to the work of the year. The company has extended its pipes about eight and a-half miles, making the present length one hundred and twenty miles. Five miles of this extension are embraced in the lines to Pawtuxet and the State Farm. The outlays for enlargements and improvements during the year were moderate. Notwithstanding the competition of the Citizens company the number of metres had been increased, and there were at the end of the year a total number of 9,968, the largest number ever reported.

The report then goes on to give some statements with reference to the new works. If there is an increase of business, such as the company experieuced for five years after the completion of the west side works, it continues, the property which it is proposed to purchase will be found very useful and may arrest the necessity for large expenditure. The increase of capital stock necessary for making the purchase will necessitate a slight increase in the present low price for gas. but the price will still be low—lower than the figures of any of the gas companies on our seaboard. The returns of the company for the first six months of this present year show a production of four millions of cubic feet more gas than for the corresponding months last year.

The report concludes as follows:

In conclusion, the Board congratulate the corporation that in passing through a period of unexampled commercial embarrassment and distress, as well as of a well-organized and strong business competition; though losses have occurred, dividends been reduced and the market value of our stock much impaired, we come to this annual meeting without debt. We are able, also, to report an unusually large stock of coal in our sheds all paid for. Having money on hand, the very low price of freight induced us to fill our sheds early in the season, and also to keep those at the west station pretty well filled, so that now we have more than 17,000 tons of coal on hand. We shall incur some debt in our settlement with the Citizens gas-light company, but as money is plenty, and the rate of interest low, we do not think it advisable to recommend the issue of more stock. After this settlement our capital stock will stand at $2,500,000, an amount quite large enough for the amount of business we are now doing.

The report was received and ordered placed on file.

It was voted to proceed to the special business of the meeting, and a resolution was introduced withdrawing certain restrictions upon the issue of stock, imposed by vote September 9th, 1872, so far as to authorize the Board to issue 8,000 shares to representatives of the Citizens gas-light company.

To carry this resolution a majority of the capital stock of the company was necessary, and the voting involved the necessity of calling over a list of five hundred names. About an hour was occupied in checking the votes. About three hundred stockholders were represented in person or by proxy, and only one, a gentleman representing forty-nine shares, said "nay" to the proposition.

The business of the annual session was then resumed.

The old Board of Directors, as follows, was re-elected: Wm. Goddard, Wm. Whitaker, Amos C. Barstow, Charles E. Paine, A. B Slater, Royal C. Taft, Edward Pearce, Jr., Jesse Metcalf, Amos N. Beckwith.

It was voted to print copies of the report of the Board of Directors, or such portion thereof as the Directors deem expedient for the use of the stockholders.

Adjourned.

At a meeting of the Board of Directors held immediately after the adjournment, the following officers were elected:

President—Hon. Amos C. Barstow.
Vice President—William Goddard.
Sec. and Treas.—A. B. Slater.
—*Providence Journal.*

The Providence gas company, at its recent meeting, adopted by an almost unanimous vote, the proposition to purchase the property and franchises of the Citizens gas-light company, and the arrangement was subsequently consummated, so that now the gas supply of the city is again under one control. The consideration paid for the property, which cost the Citizens company, it is understood, something more than $700,000, is $100,000 in cash, and $400,000 in stock at par. Notwithstanding the natural distrust of what are styled "monopolies," this consolidation, we are inclined to think, may prove the best for consumers as well as stockholders. The competing company had commenced a contract to supply gas to large consumers at a price confessedly below the cost of manufacture. A course of competition of this kind would have rapidly wasted the resources of both companies, a waste which would ultimately have to be made good by excessive taxes upon consumers. This seasonable consolidation prevents any such exhaustion, and the old company will need to make no large advance on its competitive rates to earn a fair dividend. We suppose that we consumers must look for a little higher price, but the character of the managers, no less than the moderate cost of other illuminating material, will be a satisfactory guarantee against any unreasonable advance. Probably the price of gas hereafter will be about $2 25 per thousand feet, instead of $2 00, the price that has been charged since the companies entered into active competition for the field.—*Ibid.*

THE CITIZEN'S GAS COMPANY of Frederick, Md., has commenced the erection of works to supply that city with petroleum gas. It is expected that the new gas will be supplied to customers about the 1st of November.

The Wood Gas Process.

AN OPEN LETTER TO MR. * * *.

Dear Sir: In the course of a conversation with our mutual friend, Mr. ———, we discussed some points which are likely to interest yourself. Our topics were the general character of the wood-gas process, the construction and manipulation of wood-gas apparatus; the illuminating qualities of the product, the cost of its manufacture; and, finally, its special advantages in cities which, like your own, are far removed from English, North American, and Australian collieries.

In alluding to these points, it is neither necessary nor appropriate to adopt the abstruse form of a purely technical essay; but every salient consideration, whether technical or commonplace, which should be regarded by those who seek an advantageous investment, will give tone to what I aim to make a truthful and intelligible abstract of ascertained facts.

Prof. Pettenkofer first proposed wood gas as a means of illumination in the year 1848. To Mr. L. A. Riedinger, however, is due so many improvements in this valuable industry, that he is fairly entitled to divide its honors with the original discoverer.

Among the European towns lighted with wood gas are Bayreuth, Coburg, Wurtzburg, Darmstadt, Kempten, Regensburg, Aarau, Landshut, Zurich, Giessen, St. Gallen, Ulm, Erlangen, Luzerne, Salzburg, Innspruck, Chur, Passau, Reutlingen, Heilbronn, Trient, Solothurn, Augsburg, Munich, etc. In some of these, the product was enriched by gas from boghead shale, grease, etc.; while in others the quality of unenriched gas from the firs of the great forest of Hagenau, was found satisfactory to the consumer. About 1854 Mr. J. C. Cresson, the engineer of the Philadelphia gas works, had his attention called to the subject by one Breisach, who was familiar with the German practice.

In Mr. Cresson's annual report for 1854, to the managers of the Philadelphia Gas Trust, he states "as a matter of official record, that a cord of ordinary fire wood will furnish nearly twice as much illuminating material as is obtained from the best Pittsburg coal." This year he carbonized 50 cords of wood.

In his next report, for 1855, he reports 830 cords of wood as carbonized during the year, and gives the yield of first-rate gas per cord of 128 cubic feet, at 12,000 cubic feet from common shore pine; and 15,000 cubic feet from dry oak. During 1856, 644 cords of wood were carbonized.

The subsequent abandonment of this mode of lighting, arose solely from a development of the Pennsylvania collieries and coal transport, which largely cheapened the cost of bituminous coals, as laid down in his sheds, and rendered them a cheaper gas material than the various woods.

Just before the war of the rebellion, several of the southern cities of the United States were lighted with wood gas; among them, Wilmington, N. C,, Charleston, S. C., and Macon, Columbus, and Augusta, Ga.

I was, at the time, engineer of the Savannah, Ga., gas works, making about 100,000 cubic feet per day, from the coking coals of Lancashire, England, from which we were soon afterward debarred, by blockade of our port.

I at once adopted the more appropriate iron retorts, made the requisite changes in the ovens, and supplied this town, of 40,000 souls, during four years, with a wood gas, whose mellow splendor elicited the approval of the consumer; while its economy of manufacture sustained satisfactory dividends throughout those terrible years, and won me election to a directorship in the Savannah gas-light company.

Apart from the experience thus obtained, in the manufacture of some 125,000,000 cubic feet of wood gas, I have since translated or collated the whole German practice, and built wood gas works at Reno, Red Bluff, and elsewhere.

You will see, from this necessary personal mention, that I advise you to adopt a mode of lighting with which I am familiar from individual practice, as well as from the comparison of the labors of others.

I.—GENERAL CHARACTER OF THE PROCESS.

Generally speaking, the illuminating gases from wood and coal are similarly produced, each material being distilled, or carbonized, in close vessels called "retorts," which are brought to the required high temperature by the application of heat, which is afforded by a furnace exterior to the retorts, and transmitted through their enclosure to the material within.

The tarry vapors, oily products and acids of the crude wood gas are next separated, partly by cooling impact and washing, and finally by the chemical affinity existing between the hydrate of lime and that master-enemy of the illuminating value of wood gas, carbonic acid. Thus deprived of its entangled impurities, the gas is measured and stored, and ready for distribution to the public and private lights.

II.—CONSTRUCTION AND MANIPULATION OF APPARATUS.

While the process is, as has been observed, substantially the same in both cases, wood gas demands a different proportioning of what apparatus it borrows from the coal gas manufacture, and certain applications exclusively its own. Of the latter class is the "dry-room," wherein even freshly-felled wood may be brought to a state of perfect dryness. This feature, though absolutely unrecognized in the United States, and infrequent even in Germany, is necessary to a well-ordered has-work.

No air-drying can satisfactorily strip the wood of moisture, the presence of which acts to chill the retorts below a proper temperature, to reduce both the volume and value of the gas product, to increase the quantity of lime required to remove carbonic acid, and to add 20 per cent. to the labor of the stoker, by compelling him to handle this proportionate weight of useless and obstructing water.

The wood is therefore prepared for the retorts, through the agency of the waste heat of the furnaces, by drying for many hours at a temperature ranging from 150° to 200° Fahr., 60° to 95° centigrade.

Brought, then, in say 24 hours, to a state of dryness, which even years of mere atmospheric exposure would fail to entirely effect, the wood is ready for the retort, which is a semi-cylindrical vessel, with a length of four or five times its diameter, and is kept at a cherry-red heat.

After the wood is introduced, the retort-lid is luted on, and the evolution of gas instantly begins, with a speed almost like that of an explosion at first, which rapidly diminishes to the close of the charge.

Well-dried wood requires 60 minutes to work off, while damp wood is but imperfectly distilled in 80 minutes. The gases, vapors and entangled liquids which rush from the retort to and through the hydraulic main, are composed of some 50 different compounds of the original elements of the wood, as hydrogen, oxygen, nitrogen and carbon, the chemical names of which are only of interest to the laboratory student.

Popularly, then, we may call crude wood gas a mixture of—

a. Wood tar	}	Liquids and
b. " vinegar	}	Vapors.
c. Carbonic acid	}	Gases.
d. Carburetted hydrogen	}	

Of these, we arrest the first three: and measure, store and apply the useful fourth.

After all the stress of drying, much steam is evolved from the union within the retort, of elementary oxygen and hydrogen; the water which results, dissolving the acetic acid and constituting its dilute form, wood vinegar.

Passing through the coolers, or so-called "condensers," the gas surrenders at its lowered temperature most of the tar and wood vinegar, which escape, through suitable overflows, to special receptacles.

These condensers are variously constructed:

1. As vertical tubes radiating in air or in water.

2. As horizontal tubes radiating in air or in water.

3. As "ventilating" or "flue" condensers, of the Kirkham and Wright system.

Vertical immersed tubes are preferable, where water is plentiful and cheap; otherwise, the ventilating type should be adopted.

The neophyte might suppose that this mere cooling to atmospheric temperature would deposit all the liquid matter; but as an important and, until very recently, troublesome fact, much of it remains suspended as minute bubbles of which the pellicle is a liquid film, and the contents a true gas.

Halley's theory of this "vesicular" form of vapors, has led to the invention of the Pelouze and Audouin condenser, which discharges a multitude of fine jets against opposed surfaces, and thus ruptures the enclosure, just as we crush the shell of an egg when we throw it against a wall.

Certain mechanical features of my own have improved this beautifully philosophical instrument; and, after treatment by it, vapors cannot exist at any temperature which is lower than the boiling points of the liquids which partially compose them. The indifference of the Californian quicksilver producers to the merits of this machine is unaccountable.

Having thus condensed the gas, first, by simple cooling, and, second, by mechanical impact, we proceed to take out any finely-divided wood ash which may have been carried over, the rest of the acetic acid, and some portion of the carbonic acid, in a capacious vertical cylinder known as the "scrubber."

In this vessel the gas passes upward to meet a downward flow of water, which enfilms the coke or twigs with which the scrubber is loaded from top to bottom.

The only impurity now remaining is carbonic acid, formed in the retort by the combination of part of the oxygen with part of the carbon of the original wood. But for its destructive effects upon the light giving constituents, carbonic acid might be ignored by you, as it is, really, in many towns; but in your case, the lime necessary to counterbalance its destruction of light, and you must therefore use a set of lime purifiers.

These are boxes of cast-iron, though purifiers of masonry or of wood are also used, carrying the hydrate of lime upon slotted trays of wood, and provided with movable sheet-iron covers, which enter a hydraulic joint.

I propose to give you three of these purifiers, each of which is seven feet square, and contains six horizontal tiers of the slotted lime trays.

These are connected to a rotary center valve, so

chambered that two purifiers shall always be at work, and one out of action for recharging with lime. Each working box, then, contains about 300 square feet of trays, which will jointly receive the hydrate from 1,500 pounds of quicklime, equal to the thorough purification of about 40,000 cubic feet of gas.

The gas is now completed, and it only remains to measure it by an ordinary station meter, and store it in the gasholder ready for sale.

The manipulation of the apparatus is so simple that any one of average muscle and brain can attend to it after a few days' instruction.

The fires are to be carefully attended to. A given weight of dried wood is to be placed in the retorts 16 times during each complete day of 24 hours. The overflows, gauges and valves are to be kept clean, and a fresh charge of lime is to be turned to work as soon as the lime water test shows that the gas begins to be a little foul at the outlet of the purifiers. These duties are simple enough on paper, but simpler still in the daily routine of work. It may be observed that the corrosive acids held in the crude gas are so diluted by the attendant water, that the apparatus, other than the retorts and their settings, is next to imperishable; while the completed gas is almost perfectly neutral. One of the large retorts I propose will make 20.000 cubic feet of gas per day during the "lifetime" of 300 working days.

III.—ILLUMINATING VALUE.

German experimenters say that wood gas gives one-fifth more light than coal gas, while Mr. Cresson says it is one-half better. Both these overstate the value of wood gas, or, at any rate, of the gas from such wood as you can procure.

As a fact, wood gas varies in quality according to the following conditions: The quality of the wood; the dryness of the wood; the character of the apparatus; the heat of the retorts.

The poorest wood gives say 10,000 cubic feet of 10-candle gas, per cord. Your wood, which is described as similar to our ash, will give 15,000 cubic feet of 12-candle gas.

The pitch pine of our Sierra Nevada gives 22,000 cubic feet of 18-candle gas; while the unequalled "light-wood" of our Southern Atlantic seaboard yields the great volume of 28,000 cubic feet, also, of 18-candle gas.

The residuary charcoal varies from 450 to 600 pounds per cord distilled, and is applied in conjunction with supplementary wood, as fuel to heat the retorts.

As a 12-candle gas is not likely to satisfy your consumers, some enricher must be added; and the most appropriate material will be the celebrated "Hartley shale" from Australia, 10 per cent. by weight of which will bring your cord yield up to 16,500 cubic feet of 18-candle gas.

IV.—COST OF MANUFACTURE.

In calculating this subject, I have, after consultation with your associate here, taken the elements of cost at the following figures:

1. Gas sold per day (cubic feet	18,000
2. Cost of wood used in retorts (per c'd)	$6.00
3. Cost of wood used as supplementary fuel (per cord)	$6.00
4. Cost of lime for purification (per 100 pounds)	$1.00
5. Laborers' wages (per day)	$1.00
6. Managers salary (per month)	$200.00
7. Superintendents salary "	$250.00
8. Cost of shale (per 100 pounds)	$3.25

Forty pounds of lime purify 1,000 cubic feet of gas; one cord of wood and 250 pounds of shale produce 16,500 cubic feet of gas; street leakage. 10 per cent. One cord of wood is required as extra fuel for each two cords worked off in the retorts.

From these data we obtain

MONTHLY COST OF MANUFACTURE.—600,000 CUBIC FEET OF 18-CANDLE GAS.

36 and 4-11 cords of wood in retorts @ $6	218.18
9,091 lbs. Hartley shale, @3¼	295.46
18 2-11 cords of wood in furnaces @$6	109.09
24,000 lbs. lime, @ 1c	240.00
120 days labor, @$1	120.00
Wear and tear	75.00
Clerk and Collector	100.00
Superintendent	200.00
Total, equal to $2.18 per 1000 cu. ft.	$1,307.73

You may consider the allowances for salaries and incidentals too large; in which case you will, of course, do better than stated. In this, and every other estimate, you will find that I err on the safe side. If, then, you sell gas at $6 per 1,000 cubic feet, you will nett $1,900 per month; if at $6.50, $2,200; if at $7, nearly $2,500.

In other words, heavy as your investment is, it cannot fail to be largely remunerative, apart from the great economy, convenience, safety and luxury which the municipality will reap as the result of your activity and enterprise. A sum equal to the city's present expenditure for coal oil, will make their streets, squares and public institutions one blaze of light:

V.—LOCAL ADVANTAGES.

These are so manifest and important, that I need do no more than allude to them.

Beyond the cost of, say, 50 tons of shale, and of a couple of retorts with their appropriate fire goods, the current expenses of a year will circulate in the immediate neighborhood of your city, instead of being squandered among foreign collieries.

Your wood gas will carry none of that obstinate bisulphide of carbon which, it is stated, has enured to the injury of valuable books, archives and paintings in England.

Should your port of entry ever be blockaded, your home woods will still keep up an ample supply of tolerable gas to both public and private consumers.

The thousand and one technical arguments in favor of your adoption of wood gas, induce me, finally and as the result of over 25 years' labor, to assure you that it is, beyond all comparison, your most available method, from its superior compactness, simplicity, ease of management and certainly of results. It is, in your city, an untried one; but its calm and smokeless brilliancy is delighting a hundred other towns, and it has, therefore, passed entirely out of the catalogue of experiments. Coal gas answers your purpose as well, apart from the vital objection that its cost of production is considerably greater.

Respectfully,
J. R. SMEDBERG,
Gas Engineer.

127 *Beale street, San Francisco,*
Aug. 7th, 1878.

[From the London Journal of Gas-Lighting.]

The Gas-Light and Coke Company.

The Half-Yearly Meeting of this Company was held on Friday last, at the Offices, Horseferry Road, Westminster—the Hon. Richard Howe Browne (the Governor) in the chair.

The Governor, in moving the adoption of the report, made quite a lengthy speech, from which we make the following interesting extracts:

"Now, gentlemen, I come to a point which, I daresay, many of you have anticipated that I should mention; and as it has attracted a great deal of attention out of doors, I think your are entitled to possess the same amount of information as the Board possesses as to the probability or the possibility of electric lighting superseding the present mode of illumination by gas. It has been the duty of the Board—and they have left no stone unturned in coming to the truth—to endeavor to form a just conclusion as to the merits of this new mode of illumination. They have directed their attention to it on various occasions; they have given it, even in this room, a fair trial; and it is the opinion of the Board, and it is my own firm conviction, that the proprietors of gas property have not the slightest reason to apprehend any diminution in their profits by the introduction of the electric light. I made some remarks on this subject at the last meeting, and at the meeting before—remarks which were most freely commented upon, and in the most friendly manner of approval, by the Press. I think it necessary to say that nothing has occurred since I made those remarks to alter my opinion as to the possibility of applying the electric light. We are quite aware that in large public spaces the electric light, though a disagreeable one, may be applied; but I believe there has not been a single instance of its being introduced as a mode of lighting houses, or, indeed, for lighting public lamps, in this country.

"We have yet to see whether such an experiment will be ventured upon; but, as far as my own judgment goes, if it is, it will thoroughly fail. The directors have had a most able report made to them by a gentleman of very great scientific acquirements, and fully capable of forming a just judgment upon the whole question; he is a gentleman who is very well-known to almost every gas proprietor in the kingdom—I allude to Mr. Sugg. That gentleman went to Paris as an exhibitor of gas apparatus, and he employed a great deal of his time in investigating the process of electric illumination, and the conclusions that he has come to are embodied in a report which is too long to read to you, but from which I will read one or two extracts. In the commencement, he confesses that very great strides have been made in improving the light; but he says that the expense of the light is in darkness at present. I made the same remark when last Christmas I went to Paris myself to see the manufacture of the light from the beginning; for I totally failed to get an idea of the expense of the light as compared with the expense of gas-lighting. As to the unsteadiness of the light, I pointed it out myself to the person who was most interested in it in Paris, and he was obliged to confess that there was a certain variation in its volume. Mr. Sugg says: 'I have carefully noted the effects of the electric lighting on a large scale, as shown in Paris in the Avenue de l'Opera in which there are a great number of powerful lights in close proximity. Although undoubtedly the place is well lighted, yet it does not convey to my mind anything like the effect which ought to be produced from the enormous number of candles it is supposed to represent. It was noticeable that during the illuminations at the national *fete* a short time back the oil lights and the gas jets completely overpowered the electric light by the volume of light given. The electric light looked bluish white, and the oil and gas were yellowish, but the electric lights were considerably inferior in volume of light given.' That is a positive fact, and it is one of the most extraordinary features of the electric light. The light is most intense, but there is no volume, therefore, it is not dispersed. When you see an electric lamp lighted, you say immediately, 'What a magnificent light!' But go under the lamp, and you will find you cannot read. I have tried it

myself with these very lamps in front of the Grand Opera in Paris, and have found that to be the case. Mr. Sugg continues: 'There is great intensity of light in a small space, but it appears to me that unless lenses or other apparatus can be used to convert the intensity of the electric light into volume of light it will always be inferior as a lighting agent to gas properly consumed in lights of from 100 to 300 candles. These gas lights give nearly the white pure light of daylight, with scarcely any actinism. The electric light, on the contrary, is overcharged with actinism, as compared with daylight, is blue in color, and injurious to the eyes.'

"That I can vouch for, for after I had seen the experiments in Paris I could scarcely see my way out of the place. I was so dazzled, and was made so uncomfortable, that it was some minutes before I regained my proper vision. He then says: 'No effort on my part has enabled me to arrive at anything like a true idea of the relative position of the two modes of lighting. The cost of carbons (a very important item), attendance, motive power, etc., appears to be involved in the greatest obscurity.' And so they are; they could not give me an answer on any one of these points. 'All I have seen is unsatisfactory on this head, and the relative cost appears to be, as stated to me by an eminent Paris electrician (at present) a delicate question.' That is a question that they cannot answer; it has never been solved; they make a speculative jump at it, but they cannot tell you what the comparison is between gaslighting and electric lighting. 'Comparing such a light with gas, as it is usually burnt by the public, more especially in street lighting, no idea can be formed of their relative value. The difference is probably as great as that between the old Roman lamp and the moderator lamp of the present day.'

"So that Mr. Sugg's opinion, as far as it goes, is very decided as a confirmation of what I have stated, that we need have no great fears as to our property being deteriorated by this mode of illumination."

On Recent Improvements in Gas Motors.

By M. Armengaud, Jun.

The motive power in a gas engine is obtained by exploding behind the piston a mixture of ordinary illuminating gas with seven or more times its volume of air. The heat developed by the complete combustion of the gas amounts to about 6,000 calories per cubic meter (674 British units of heat per cubic foot), and raises the temperature of the gaseous mixture, after the explosion, to from 1,200° C. to 2,800° C., according to the greater or less excess of air that it contains. Part of the heat of the burned gases is transformed into motive force, by their pressure against the piston, as they expand; but the greater part is taken, in all the older engines, by the walls of the cylinder, which thus tend to become rapidly heated, and are kept cool by a water jacket.

After a brief sketch of the history of gas motors, M. Armengaud points out that they may be reduced to two classes: those like the Lenoir engine, in which the force of the explosion is employed to move a piston connected directly with the resistance to be overcome; and those in which, as in the original engine of Otto and Langen, the explosion acts against a free piston, driving it up, and leaving behind it a partial vacuum, as the gases cool, in virtue of which the pressure of the air acts on the piston, to force it back, and thus develops the effective work during he return stroke. In the latter engine the expenditure of gas is much less than in Lenoir's motor, but the noise it makes in working forms a great objection to its use; and the most improved engines, those recently brought out by Herr Otto of Cologne and by Mr. Louis Simon of Nottingham, are of the former class. The new features of both these plans are the compression of the explosive mixture previous to its ignition, and the gradual character of its inflammation.

Herr Otto's engine resembles in its general arrangement a single-acting steam-engine, with a horizontal cylinder open at one end, closed at the other, and provided with a heavy fly-wheel. The cylinder acts, at the same time, as the compressing pump for the mixture of gas and air. The piston, at the bottom of the stroke, leaves between it and the closed end of the cylinder a space, the compression chamber, the volume of which is generally equal to two-thirds of that swept out by the piston, or two-fifths of the total capacity of the cylinder.

The complete period of the action of the engine is that comprised in two revolutions of the main shaft, or four strokes of the piston. The successive phases are as follows:

(1) The piston advances towards the open end of the cylinder, and draws in the mixture of gas and air.

(2) The piston returns and compresses the mixture to two-fifths of its original volume.

(3) As the piston reaches the end of the stroke the mixture is ignited, and again drives it forward.

(4) Lastly, the piston returns again, driving out before it the greater part of the burned gases, and a fresh cycle of operations begins.

Thus, of four successive strokes, forming one cycle, one only, the third, transmits motive force to the shaft; the second, in which the gaseous mixture is compressed, con umes force; and the first and fourth are indifferent. Hence the necessity for a heavy fly-wheel. The supply of gas is cut off by the governor when the speed becomes too great. The valves admitting gas and air are so arranged that a feebly explosive mixture of 18 parts of air to one part of gas is first introduced into the cylinder, and then a smaller amount of a strongly explosive mixture of seven parts of air to one part of gas. As two-fifths of the volume of the cylinder, next to the piston, are already filled with inert gases, the mixture, from being most strongly explosive next to the port of admission, becomes less and less so nearer to the piston; and its explosion is thus rendered less instantaneous than that of a homogeneous mass of strongly explosive gas, while its ignition is ensured by the strongly explosive portion being that fired first, and a great part of the heat of explosion is employed in expanding the mass of inert gases contained in the cylinder.

The heat is thus better utilised than it is, for instance, in Lenoir's engine; the proportion lost in heating the walls of the cylinder, being, in the latter case, 85 per cent. of the total heat evolved; and in that of Otto's engine only 42 per cent.

The object of compressing the gases before explosion is to increase the power that may be obtained from an engine of given size. It reduces, however, the theoretical economy of the engine, as compared with that of one worked without compression, by about 25 per cent.; but the advantage gained, in Otto's engine, by the gradual character of the explosion is so great, that notwithstanding this loss, the consumption of gas is practically not more than a third of that in Lenoir's, or less than one cubic metre per horse-power (35·8 cubic feet per British horse power) per hour. It is also almost noiseless in working, and its small size in proportion to the force it gives out is likely to render it suitable even in some cases where engines of considerable power are required.

In Mr. Simon's engine the mixture of gas and air is compressed in a separate cylinder, and is introduced into the motor cylinder as a jet, during the greater part of the stroke. Here it is lighted by a gas flame, as it flows in, and expands, pushing the piston before it. The ignition thus takes place gradually, during nearly the whole of the length of the stroke; and the greater part of the heat evolved is transformed at once into motor force, but little being spent in heating the cylinder. Little water is thus required for cooling, and the expenditure of gas does not, according to Mr. Simon, exceed one-half cubic metre per horse power (18 cubic feet British horse power) per hour.

Short notices are given, in conclusion, of the small gas engine of M. de Bisschop, made of one-fifteenth and one-third of a horse-power, for driving sewing machines and for other light work, and of that of M. Ravel. W. H.

—*Resume de la Societe des Ingenieurs Civils*, 1878, *p.* 53.

Stagnation in the Petroleum Trade.

Unusual depression in the market here for petroleum oil exists at present, and prices are down to about the lowest range of values before known for a very long time.

Exporters say there is no demand from abroad now, as all their demands are fully supplied. On Change nothing is doing, and business has become quite nominal. The highest price yesterday for crude oil was $1 per barrel, and the lowest 98½c. At Oil City yesterday refined petroleum was down to $1 per barrel.

It is thought in the trade the European demand for American oil is likely to be affected at no distant day by the discoveries of oil wells abroad. Machinery manufacturing companies of this city have recently received orders from St. Petersburg for considerable quantities of oil well engines, pumps, pipes, etc., to be shipped immediately to points at the shores of the Caspian sea, in Russia, where some important oil discoveries have been recently been made by Americans.

It is said ex-Governor Curtin, of Pennsylvania, is interested in the project of developing oil wells at several points in Russia.

Some samples of the oils sent here are of a very rich and heavy quality.—*New York Express*, *August* 27.

Analysis of Spent Lime from Gas Purifiers.

The material in question was obtained from a gas work in London. Column 1 gives the author's (A. Gayard) analysis; and column 2, one executed by the late Prof. Graham:

	1st.	2d.
Hydrate of lime	15·10	17·72
Carbonate of lime	34·20	14·48
Sulphate of lime	0·25	2·80
Sulphite of lime	1·50	14·57
Sulphide of calcium	6·90	
Oxysulphide of calcium	3·20	
Hyposulphite of lime	11·80	12·30
Cyanide of calcium	0·25	
Sulphide of iron	0·55	
Free sulphur	4·30	5·14
Silica	1·80	0·71
Alumina	0·70	
Magnesia	trace	
Coal tar and oil	0·25	
Water	19·20	32·28
	100·00	100·00

From these results it would seem that Graham's sample had been exposed to the air for some time, while that of the author was submitted to analysis immediately on its withdrawal from the purifier.—*Chemical News.*

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MONDAY, SEPTEMBER 16, 1878.

Official Report of Examinations of Gas for two Weeks ending Sept. 7, 1878, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Aug. 1788.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gar-Light Co.	Municipal Gas-Light Co.
26	Between 6 A. M. and 9.30 A.M.	17.70	16.36	20.59	16.73	16.56	
27		16.95	16.30	19.87	16.40	16.32	
28		17.28	16.20	19.97	17.55	15.82	
29		16.01	16.95	19.24	16.05	16.42	
30		17.04	17.04	18.90	16.67	15.73	
31		17.74	18.00	19.82	17.57	16.93	
	Average	17.12	16.81	19.73	16.83	16.30	
Sept. 2		16.09	17.42	18.99	16.37	16.15	
3		16.97	16.81	20.14	16.96	17.63	
4		16.04	17.27	20.50	16.34	17.77	
5		16.18	17.38	20.41	17.50	16.79	
6		16.52	16.89	18.54	17.23	16.90	
7		15.94	16.40	18.51	16.90	16.84	
	Average	16.29	17.03	19.51	16.88	17.01	

Sugg-Letheby burner.
E. G. LOVE, Gas Examiner.

THE NUMBER of visitors to the Paris Exposition during the months of May and June was 1,666,879 admissions in May and 2,555,523 in June, the increase in the latter month being due to the fact that the Exposition and its annexes were not completely ready till the end of May.

New England Association of Gas Engineers.

The Semi-annual Meeting of the Association was held at the Allyn House, Hartford, Conn., August 15, 1878. The meeting was called to order by the President, S. G. Stiness, Esq., at 12½ o'clock P. M. Upon taking the Chair he made a short address, congratulating those present upon their opportunity of meeting together again for the purpose of receiving and imparting information relative to the important business under their charge and management, and for renewing and strengthening pleasant social relations with each other. He stated that as much time as could possibly be allowed would be occupied with business and with discussions upon subjects relating to the manufacture and distribution of illuminating gas; but that this gathering would be more of a social than of a business and formal character. In concluding his remarks, he wished for those present a pleasant and successful meeting.

The roll was then called by the Secretary, and twenty-six members answered to their names. Among those present were Charles Nettleton, Esq., Secretary and Treasurer of the American Gas-Light Association; Capt. W. H. White, formerly Engineer of the Citizens' Gas-Light Co., of Brooklyn, N. Y.; Dr. Sloane, present Engineer of that Co.; Charles E. Sanderson, Esq., representing the AMERICAN GAS-LIGHT JOURNAL; also, Messrs. Davis, Langford, Ellis, Sprague, and others, dealers in machinery, etc., employed in the gas manufacture and distribution.

A full report of the last annual meeting having been published in the AMERICAN GAS-LIGHT JOURNAL, it was voted to dispense with the reading of the record.

A letter was read by the Secretary from Mr. Gerdenier, a member of the Association, expressing his regret at not being able to be present at the meeting, and giving figures showing by comparison the yield of gas per pound of coal at the works under his charge, for the five months of the years 1877–8 ending Aug. 1, by which it appeared that a very marked and satisfactory improvement in yield had been made in the time named of the year 1878 over that of the previous year. It was voted that the communication be placed on file.

The Chair announced the decease of a member of the Association—Benjamin G. Raymond, late Superintendent of the Woonsocket Gas Co., R. I.,—and made a few fitting remarks suggested by the sad event. It was then voted that a Committee of three be appointed by the Chair to prepare suitable resolutions of respect to the memory of the deceased associate, to be submitted to the Association at its next annual meeting.

The Chair appointed as that Committee Messrs. W. J. Miller, Edwin Evans and Andrew Hutchison.

The first subject presented to the consideration of the meeting was that one, so particularly interesting at this time to stockholders and managers of gas companies, and to the public generally—the Electric Light. Statements were made by several speakers relative to their observations and experience in regard to the operation and effect of this new method of illumination. The remarks of Mr. Charles H. Nettleton were exceedingly interesting, as they contained much new and reliable information regarding the cost of the new light, of its production and its application as an illuminant in several instances which he named.

The next topic considered was the production and price of petroleum oil, and Mr. Charles Nettleton, having been called upon, gave facts and figures bearing upon the subject. Messrs. Gerould, Rollins, Jones and others then gave the results of their experience in the use of oil or naptha for enriching coal gas.

Other subjects were discussed briefly, such as Water Gas, Engines for Motive Power, Street Light Extinguishers, etc. Mr. Harbison, Secretary of the Hartford Gas-Light Co., gave a cordial invitation to those present to attend a reception at his residence in the evening, at 8 oclock, which was accepted unanimously. The Secretary laid before the meeting the programme for the remainder of the time, which had been prepared by the Committee of Arrangements. It was then voted to take a recess for dinner, and meet at three o'clock, preparatory to taking seats in the carriages provided by the Directors of the Hartford Gas-Light Co. for the purpose of visiting the Gas Works and other places of interest in the City.

At the time appointed the members and their friends assembled, and were soon on their way to the Gas Works, which they found in admirable condition. After quite a thorough inspection of the same, under the guidance of Mr. Harbison, the party visited the extensive establishment known as the "*Colts Arms Company*." While there, each one availed himself of the privilege of discharging one or more shots from the famous Gattling gun, at an improvised target, with more or less success. During the extensive ride about the city, the visitors had an opportunity to observe the new Capitol, the new Trinity College, and many other points of interest to the stranger. Returning in time for supper, that meal was soon dispatched, and, at the hour appointed, the party proceeded to the residence of Mr. Harbison, in two large stages provided for that purpose by him. There they found a most elegant and delightful reception awaiting them, and the time passed rapidly, with music, conversation, and a bountiful repast.

Just before the company separted, the President called the members to order, and made a few remarks complimentary to the Directors and Secretary of the Hartford Gas-Light Co., for the kind and hospitable manner in which the Association and their friends had been entertained. It was then voted, very unanimously, that our sincere thanks be tendered to the Directors, and particularly to the Secretary of the Hartford Gas-Light Co., for their kind and cordial hospitality extended to us, and for their very successful endeavors to make our visit at Hartford a pleasant one. In response to this, Mr. Harbison made a few remarks, expressing his pleasure at meeting his friends on this occasion, and the gratification which he shared with the Directors of the Company, that they had been able to contribute, in some degree, to the happiness of their visitors. Remarks were made by other gentlemen residing in Hartford, after which the guests returned to the hotel, highly pleased with the elegant reception given them.

At nine o'clock on the following day the party went on board the little stern-wheel steamer "Dexter," and spent the day on the beautiful Connecticut River, sailing down below Middletown, and returning late in the afternoon.

With commendable foresight, the Committee of Arrangements had secured the services of a skillful caterer, who took good care that no one should suffer on the voyage from hunger or thirst.

Upon returning to the hotel the members and their friends took leave of each other, and separated highly delighted with their visit, and with mutual congratulations upon the success and enjoyment of the reunion.

GEO. B. NEAL,
Secretary.

Observations with Reference to the Researches of M. Rosenstiehl on the "Absolute" or "Ideal Black."—M. Chevreul.—The author quotes a passage written in 1835: "If the light falling upon a body is completely absorbed by such body, so as to disappear from view, as if falling into a hole perfectly dark, then the body appears to us black, and only becomes visible because it is contiguous to surfaces which reflect or transmit light. Among black bodies we know none which is perfectly so, and this is because they reflect a little white light, by which they affect our sight. What proves this reflection of white light is that the blackest surfaces, if polished, reflect the images of illuminated objects placed before them."—*Chemical News.*

[From "Journal of Gas Lighting."]

British Association of Gas Managers.

Mr. GORE, as one who had suffered very considerably from what he believed was a misconception of the very important question now brought forward, namely, the relative proportion that capital ought to bear to works constructed for the manufacture of gas, wished to give a few words from his own experience and observation. For many years it was the custom to debit capital with all the expense connected with the promotion, construction, and completion of gas works, and for many years it was considered that that capital was entitled to receive its maximum dividend. A clause in the Gas Works Clauses Act of 1847 was looked upon as a clause which gave shareholders an indubitable right to 10 per cent. on all the capital they had expended. The effect of reading the clause in that way, and the influence it had on gas property, was this, that there had been a disposition on the part of those who were connected with profitable gas works to increase their investments in all directions, and no one could wonder that such was the case. It was the best investment in the country at the time, and gave the best guaranteed return on that capital; therefore, it was only natural that shareholders should do their utmost to enlarge so profitable an investment. But what was the effect on Members of the Association—the men from whose brains must come that which enabled the capital to be made productive, and who were, therefore, deeply interested in seeing how the capital was expended? He need not ask the question, how much anxiety gentlemen had to pass through in order to meet that pressing demand for 10 per cent. on capital? If the capital had been reduced to such a point as would approximate to that which the works demanded, how much less anxiety would they have had in producing the return on that capital? Need he ask how many works there were whose working capital was not yet represented, to the extent of one-half, by the plant which was now in operation?—how much of it had been totally destroyed? He could refer to many works, and he almost thought he could point out one to which Mr. Livesey had alluded, where the original capital had been entirely destroyed, and new capital created; and yet the Manager was expected to pay a dividend on that double amount. Then there was another point of equal importance. Mr. Livesey had told them plainly that in this country they were accustomed to work with an unnecessarily large amount of capital. It had been his lot to visit a great number of works in various parts of the world, and he had been enabled to contrast the works constructed, not only in this country, but in many of the principal foreign cities, with those constructed essentially on what he might call British principles. He had seen works which had fulfilled all necessary requirements, with all the retorts and plant economically in operation, at a reduction in some instances of 40, 50, or even 60 per cent. on the capital required for those constructed under English *regime*. The facility with which capital was obtained in this country for the construction of works abroad had had this result, that companies had burdened themselves with capital which, at the present time, did not show anything like the return it ought to do, He would take a case with which he was personally connected. They had the works constructed abroad, upon what he might call cheap principles, but which enabled them to supply the district economically and advantageously. The capital was, in round numbers, £40,000, and on that capital for eight years they had paid on an average 19¼ per cent. An English company, established on English plans, with a plant only capable of making something like 10 million cubic feet a year more than their own, cost, as the balance-sheet showed, £118,000. Now, it was quite evident that, if the Manager of those works had been placed in competition with his, his 19¼ would appear a large return compared with about 6½ or 6¾ per cent. return from the other. He had in his mind's eye two or three concerns which he saw a few years ago in South America, where capital at least 40 or 50 per cent. more than it ought to have been had been expended in the works, and very naturally there was not a proportionate return. Gas Managers, therefore, had a great interest in keeping down capital. He believed the auction clauses objectionable, although they might appear to have a tendency in the right direction, provided they could inoculate shareholders with common sense principles, namely, that if Managers and Engineers were to put their brains and intellect into their work, they should have the benefit. They had progressed within the last 50 years enormously. They carried on a business second, either in interest or domestic value, to no process carried on in the country.

Mr. H. P. STEPHENSON said he had no doubt the principle enunciated by Mr. Livesey, that all renewals, or partial renewals, should come out of revenue, was sound; but when a great amount of work fell in one year, it came hard upon a company. The great difficulty he saw in meeting all the expenditure that might come in one year was that the profits might be depreciated in that half year. Mr. Livesey suggested a sinking-fund; but how did he propose that should be carried out? And was it possible, in the present state of legislation, to have such a fund?

Mr. MEAD (Sutton) thought they were much indebted to Mr. Livesey for his valuable paper. The figures he gave applied, as stated, more especially to large works than small works; and he must say that his experience had been limited to comparatively small works, with capitals from about £3,000 to £300,000; and the difference between the capital necessarily expended in the establishment of those works was very great indeed. He put it, not as Mr. Livesey did, in tons of coal carbonized, for he did not think that was the most convenient form, but rather in thousands of feet of gas sold. In some works a much larger quantity of coal might be carbonized than elsewhere, although not so much gas was paid for; therefore, he based his calculations on the number of thousands of cubic feet of gas sold. He found that the capital averaged from about 16s. and upwards per 1,000 cubic feet of gas sold. He was sorry to say he had lately joined a board in which the capital expended was 34s. per 1,000 feet sold. He did not mean to justify that at all, for there was evidently a large sum of money wasted. If the works were increased as the business extended, he agreed that all old plant disused should be compensated for out of revenue. He knew in former days, even at the works where the President was now Engineer, things had gone in a different direction. If he recollected rightly, when Mr. Livesey, Sr., took the management of the South Metropolitan Works, they were something like £80,000 to the bad. The Engineer was an extravagant man, and had spent, no doubt, too much, and, in order to pay good dividends, charged a great deal to capital that very properly belonged to revenue. It was a question what was fair to do. Supposing, for argument sake, that £1 per 1,000 feet, or £1,000 per 1,000,000, feet would be a very fair sum for gas works, there might be two Managers, one not quite so careful as the other; the one would buy a great number of things out of revenue, and so reduce the capital, until at last, as in the South Metropolitan Company, they would have a capital of something like 10s. 7d. per 1,000 feet sold. In their case 1s per 1,000 feet would pay 10 per cent. on the capital all round; but with £1 of capital per 1,000 feet it took 2s. to pay 10 per cent. How far, then, was it fair to now go on paying out of revenue certain sums which ought properly to come out of capital—he meant fair to other companies who had not the opportunity of doing so? The effect would be this—that one company, in a very favorable situation, might earn full statutory dividends, and yet place a large sum out of revenue to capital account, by paying for things that ought properly to come out of capital The result would be that one company, say at Plymouth, sold gas at 2s. 6d. per 1,000, the other company, who had but acted fairly, not only to their shareholders, but also to consumers (for the consumers for the time being had to make up this difference, whatever it was; and if a company were spending out of revenue what they ought to spend out of capital, the consumers for the time being had to find the money, though ultimately the succeeding consumers had the benefit) could not afford to sell under 4s. The public said, "At Plymouth the gas is 2s. 6d.; why do you charge 4s.?" It had that damaging effect on other companies. He thought the right principle was this: You ought to pay for all damage to your property, replacement of gasholders, and so on, out of revenue. If you turned out one holder containing 100,000 feet, and put in one for 200,000 the one replaced ought to be charged to revenue. There should be a suspense account, and if too much was spent in renewal of property this year, more than could reasonably be paid for out of revenue by means of the suspense account, as much might be cleared off as could be afforded this year, and the balance next and the year after. But even this might be carried too far; and it was carried too far when the capital was reduced below what would be a fair sum for the construction of the works.

Mr. GEORGE E. STEVENSON (Peterborough) said it appeared to him this question was one that required most careful consideration, and that it was one very difficult to decide upon. It was very difficult sometimes to ascertain the circumstances under which gas companies arose. It was somewhat easy to lay down a rule by which new gas works should be constructed, but to say that the capital of any special gas company ought not to exceed so much, and that if it was more it was too high, was an arbitrary process which no one was justified in adopting, unless he thoroughly knew the circumstances under which the company was constituted. For instance, his own company was one which might easily be misinterpreted. It was a small company, formed as late as 1868. Previous to that the gas works were the property of a private individual, who managed his affairs on the most economical principle possible, for he never repaired anything. The consequence was, the works fell into such a state of disrepair and incapacity that he was quite unable to supply gas, and unwilling to extend his supply. The consumers of the town of Peterborough, therefore, decided to go to Parliament to form a company, which they did, and received powers to purchase the works of this private individual. They had to give for those small works, which produced, at that time, about 20 million feet a year, £30,000, and of that £30,000 not one shilling was represented at the present day in the Peterborough Gas Works, because the whole of the apparatus was utterly useless, and had to be pulled down and new works constructed. That £30,000 saddled the small gas company at Peterborough with such a large amount of capital in proportion to the present make, that anybody seeing it at first would hold up his hands in astonishment. From the time the old works were purchased the most economical principles had been observed, and since that time a contingent-fund had been formed and added to year by year, to which all unusual outlay, in the way of reinstatement, was charged. In most cases it was immensely difficult to attain to that point at which it could be said that capital was proportionate to the make of gas, and to charge a reasonable price, because the capital must necessarily bear its dividend, and directors and shareholders were not willing to lose their dividend for the sake of reducing the price. It appeared to him also that it was questionable whether it would be desirable in such a case as that, or even one less remarkable, to deduct year by year a portion of the originally expended capital, with the object of finally erasing it from the books, because to do that it would be necessary to maintain the price of gas enormously. He was interested in the remarks of Mr. Gore with regard to English enterprise abroad, but from what he had seen on the Continent of Europe during three years' experience, he found that Continental companies were infinitely more lavish in

their expenditure than any English. They not only spent money lavishly in works, but before the works were constructed, or anything was done in the floating of the company, a large amount of capital was sunk and wasted. Certainly in Austria it was found that not more than one-third of the capital was represented in actual works, the remainder finding its way into various people's pockets beforehand.

Mr. HUNTER (Stafford) said that Mr. Livesey would perhaps inform them how a company like his own could form a sinking-fund to meet extraordinary expenditure. In that respect probably corporations might have an advantage over companies. They might have more freedom in manipulation than a company. In Stafford they got over the difficulty by having two different funds—first a sinking-fund, which was applied to the reduction of the mortgage debt, a certain proportion of the receipts being set aside for that purpose, so that the entire debt would be paid off in about 50 years; then there was another fund ,or depreciation or replacement, to which they credited each year something like 2 or 3 per cent. Two or three years ago they were unable to put even 1 per cent on one side, but during the past two or three years they had been enabled to make up for past deficiencies, and put as much as 3 per cent. to it. Last year they put £20,000 to that fund alone. This would soon swell up to a considerable amount, and out of it they could make all the renewals. Though this could be done in a corporation, he did not know how far a limited company could do it. The main object of the paper, however, was to show that the capital account should bear some relative proportion to the value of the plant, and the writer had given as a standard 11s. per 1,000 feet. There was no question but that this could be done. They could keep their extensions within this margin, and it did seem almost impossible to account for the extraordinary discrepancies which from time to time were brought to light.

Mr. PENNY said he had noticed there was a mistiness in the description given by some gentlemen who had already spoken in reference to repairs and reinstatements, which out to be cleared up. His experience in examining companies' accounts went to show that in many companies if a new holder was erected, or new mains were laid down, they contented themselves with charging to revenue the cost of the new gasholder or new mains, and then debiting capital with the amount which the old gasholder or old mains produced. That was an explanation, to some extent, of the very large increase of some companies' capitals, and of the great disproportion between the capital of one company and that of another, as shown by the sum per 1,000 cubic feet which the capitals represented. Having regard to this great difference between the capitals of various companies, he could not help thinking that this had something to do with it, though, no doubt, many practical men present could speak better on that point. As a matter of course, they knew that the old companies, where they made works of small capacity, and where there had been a rapid growth—where they had to create and recreate—their capital would have a great tendency to swell up. It was a matter of little consequence what the capital was if there was a price for gas that would pay for it; but it was those companies who had had constant contests, where the maximum price had been kept down, who had been driven to deal with their capitals in a way, perhaps, not the most proper. For when the board had shareholders to meet and dividends to produce, there was a great temptation to deal with reinstatements in the way he had described. There was no doubt that if they had to begin gas works now, knowing all they did know—taking a square piece of ground, putting down everything of the best form possible—they might make the capital account very small as compared with that of many old companies. But they ought to have some feeling for those companies who were born so early, and had had all the difficulties of early times to encounter. Those were the companies who had been unable to create and maintain any reserve-fund. They were really objects of sympathy compared with those founded in later days, who had the benefit of all previous experience.

Mr. CARR (Halifax) wished to ask whether Mr. Livesey meant the standard which he laid down to refer to the capabilities of the works, or to the quantity of gas they sold. Some small works might be very favorably situated, and up to a certain time the capital might be small; but if they were in a growing district, and had to extend, they might not consider it wise to incur expenditure, with a view to keep within that standard from year to year. They might have to make an addition, which would elevate the standard for the time being, until the demand again overtook the supply.

Mr. CHAPMAN (Harrow) said one important point was whether the preliminary and parliamentary expenses ought to be charged to revenue. As a rule, those expenses were charged to capital. He thought Mr. Livesey's idea was a good one, and his (Mr. Chapman's) directors had adopted that view. They had a very much larger capital per ton than Mr. Livesey spoke of, as they were a bought concern, like Mr. Stevenson's company at Peterborough; but they had already written off £452 for preliminary and parliamentary expenses, which amounted to £2,000, and intended to write them all off, although they had not yet paid a 10 per cent. dividend.

Mr. IRONS (Gosport) thought Mr. Livesey would add to the obligation he had conferred if he would tell those outside the Act of 1871 what reserve-fund they could form.

Mr. LIVESEY, in reply, said Mr. Carr had referred to companies getting 10 per cent. That wanted a little correction in this direction. They did not get 10 per cent after the passing of the Act of 1847 for a great many years—in fact, so long as competition lasted; but when that ceased, full dividends were secured. It was then the opportunity should have been taken to make those renewals. Mr. Stephenson spoke about the sinking-fund, but the reference to a sinking-fund was intended only to apply to cases, for instance, such as the chartered company in building Beckton. It was impossible for the chartered company to lay out many hundreds of thousands of pounds, part of which was in place of old works, amounting also to hundreds of thousands, and charge all of them to revenue; but he did think it would be advisable to form a fund which should in time redeem it. One of the London companies had, by parliamentary sanction, a leasehold redemption-fund, and there might be seen in their accounts from year to year so much charged on the revenue account to that fund. Where it was a case such as the chartered company, they might have obtained a special authority from parliament for a separate fund; but in the case of small works, under the Acts of 1847 and 1871, he did not recommend going for an Act of Parliament for such a purpose. Still, he thought the ingenuity of accountants might find out some means of meeting this without great difficulty. He did not profess to be a parliamentary lawyer, but he had found this out about Acts of Parliament, that in many particulars they were very imperfect indeed, and certainly not adapted to the circumstances to which it was supposed they were to apply. Therefore in many cases he should say, if it is right to form such a fund, do it; and who was there to object? There were companies under those old Acts who were carrying on business in such a way as this. He knew a company who had hardly called up any capital at all for nine years, and yet that company had in nine years renewed the works and converted them from the most dilapidated, wretched state, into a thoroughly perfect condition, and beyond this they had also made great extensions out of revenue, thus reducing their capital, without any objection on the part of anybody. Certainly they had kept up the price of gas rather higher than was desirable, but now they were in a thoroughly sound position, and it would probably be reduced.

The right way to deal with ordinary renewals was, that every year should bear its proper proportion. It required some little management to get into that system, but it was thoroughly possible to adopt such a system that the average cost of repairs should be about the same year by year. Again, it was possible to have an undivided balance to carry forward in prosperous years, and that was often done by companies who might have something over and above the dividend, and possibly over and above the reserve-fund. He could name companies who had reserve-funds, and then carried forward an undivided balance from year to year. The South Metropolitan, for instance, had their reserve-fund full, and another, almost equal, as an undivided balance, in 1872. But, as it happened, the coal famine came next year, and although they had reduced their price, the undivided balance tided them over the famine years very nicely. Where there were no auditors to look after the accounts, he did not see much use in the Acts. As to Mr. Mead's remarks with regard to gas works with capitals of from £3,000 to £300,000, he had always regarded Mr. Mead as a man who did his work in a thoroughly good way, and on principles of the greatest economy; and therefore he thought he must be mistaken when he said that the amount was from 16s. per 1,000 feet of gas sold for works from £3,000 to £300,000. If Mr. Mead referred to works with a capital of £3,000 he was not going to dispute it, but for works with a capital of £300,000, he did dispute its necessity most emphatically. For works with a capital of £20,000 or less, 11s. per 1,000 feet, or £5 per ton was sufficient. Mr. Mead referred to one particular company when he said the works exceeded in value the total amount of the capital, and he had already said they were not to be imitated. He thought they were just as far in error in one direction as the others were in the opposite. Those companies who had reduced their capital below what it ought to be, had inflicted a great injustice upon shareholders and consumers, and also on other gas people; in fact, they had done badly all round, for the consumers had had to pay for the extensions which the shareholders might have provided for out of capital. The shareholders would have had increased dividend-paying investments, and the consumers would have paid a fair price for their gas, and everything would have been right. With regard to Mr. Stevenson, he could quite sympathize with him, but as to paying £30,000 for that which was not worth anything, if anyone chose to give a sum of money for that which was worthless, he must look upon that money as lost. It was only the exceptional circumstances in which gas companies were placed which enabled them to do such a thing. An ordinary trader could not give £30,000 for a mill which he had to pull down, and expect he was to get interest on that £30,000, as well as on the new building he erected. There might be special circumstances with which he was not acquainted, over which the company had no control; but in that case he should say the safe and right course was to endeavor to reduce the capital as much as possible, and to make all extensions out of revenue, which could undoubtedly be done. With regard to the sinking-fund, for any legitimate purpose, such as the redemption of leasehold property, etc., he would consider a certain sum set aside annually for such a purpose as perfectly right, and that, whether provided for in the Act or not, it was not a matter to which objection could properly be taken. Mr. Penny had alluded to a certain mistiness on this question, and he was afraid that was the cause of a great deal of discrepancy in gas companies' management. What they wanted to learn was the exact way of dividing capital and revenue, and there was a great deal of debateable ground between the two. To take an illustration from railways: One great railway enlarged its stations and replaced iron rails by steel, and charged all the cost to revenue. Another one enlarged its stations and replaced iron rails by steel, charging the difference in value between the new new stations and the old, and the iron rails and

the steel, to capital, though these things did not increase the earning power of the railway to any appreciable extent. He thought the course adopted by the first was the sound principle, whenever it could be done, though he would not say the other was wrong. In reply to Mr. Carr, he did not mean to say there ought to be an exactly defined certain sum for extensions every year, and that they ought not to exceed or go below that, but he maintained that on the average of years it ought not to exceed the sum he had stated. As to parliamentary and preliminary expenses, most Acts of Parliament said that expenses o that kind should be charged to capital; but that did not prevent them being afterward written off. All they had to do was to endeavor to conduct their affairs on such sound principles as they would be compelled to do if it were an ordinary business, and then they would not be afraid either of Acts of Parliament, or official auditors, or any other authorities' No doubt there was a good deal in the paper with which some gentlemen would not agree; but, if so, they were quite as free to hold their own opinion as he was. It was the result of his own experience, and must be taken only for what it was worth.

The PRESIDENT said whatever doubt might have been suggested to the Committee as to the propriety of introducing this paper, had been entirely set aside by the interesting discussion which had arisen. Mr. Livesey had referred to the widespread dissatisfaction which had existed since the Metropolis Gas Act of 1860, as showing that the manner in which companies had conducted their business had not been satisfactory to consumers and the authorities; that the system was not satisfactory, or the results would have been better. He thought there was another way of regarding that question of dissatisfaction which had been expressed with regard to gas companies—namely, that since the passing of the Act of 1860, which consolidated and improved the value of the property so much, the London companies had been paying very full dividends, and then, for the reasons which Mr. Penny had sketched out in his paper, they had been naturally objects of envy, hatred and uncharitableness. As to the remarks that Mr. Carr had made on the influence of the Act, and the passing of the Act of 1847 having been to secure the payment of maximum dividends, he was glad Mr. Livesey had referred to it, because the influence of that Act was not by any means to secure maximum dividends, or to give anything like security to companies that they should have maximum dividends. During the whole period between 1847 and 1860 he knew of no instance, and he believed there were very few cases of companies paying full dividends. During all that time the competition which was thought so desirable to exist between people engaged in any business existed, and the result was high prices and small dividends. The "regulated monopoly" introduced partly by the Act of 1847, and confirmed by the Act of 1860, brought about that condition of things in which gas companies rejoiced at the present time. He would only say further that, while it was very desirable to watch the expenditure of capital, it was still more important to see to it that the works were always in full, efficient, and good condition, and money spent in that direction should not be looked at with too close an eye. So long as capital was well spent, it was well to spend it.

TUESDAY, JUNE 18.

Mr. C. HUNT (Birmingham) read the following paper on

PREVENTABLE WASTE.

It is probable that few manufacturing processes are conducted without a certain amount of waste. When, however, as is said to be the case in the manufacture of iron or of metallurgical coke, this is not avoidable by any known methods, the manufacturer may, with untroubled conscience, pursue his way to further improvements; but when, as with coal gas, such waste, either in the process itself or in the consumption of the manufactured article, is strictly of a preventable nature, with our regrets at its occurence must be mingled a feeling of something like self-reproach.

It was estimated by the Royal Coal Commission in 1867–68 that the annual consumption of coal within the United Kingdom for gas-making purposes amounted at that time to 6,500,000 tons. Allowing for an increase since then at the moderate rate of 3 per cent. per annum compound, it would appear that the total yearly consumption cannot now be less than 8,500,000 tons. Of this fully one-fourth, or, to be well within the mark, say 2,000,000 tons, representing a cost to carbonize of not less than £1,500,000 annually, may not unfitly be described as preventable waste.

This undesirable condition of things is brought about by a very simple means. Pressure within the retort at the moment of evolution, and this same pressure injudiciously exerted at the point of combustion, is directly responsible for by far the largest share, while neglect of the necessary precautions for the efficient maintenance of the distributing apparatus frequently, by the loss which it occasions, operates as a serious check upon the profitable development of gas undertakings.

In submitting a few observations, with a view of pointing out some of the ways by which this enormous annual loss may be diminished, I am aware that I am treading upon ground which has been rendered familiar by the labors of many of our members, and am conscious of the difficulty of finding fresh matter for discussion; yet I trust that some good may result from a periodical recurrence to the subject, and from an endeavor to show that, great as may have been the improvement during the last few years, there is yet room for the exercise of considerably more economy than genenerally prevails.

In the first place, then, what proportion of this loss may be attributed to the carbonizing process, as ordinarily conducted? We usually guage the success of this opertion by the yield of gas per ton, regard being had to its illuminating power; and there can be no question as to the value of this as a matter of comparison. But is is clearly impossible, in this way alone, to determine the results of our operations; for to do this it is necessary to take into account the whole of the products, and compare them, weight for weight, with the coal whence they were derived. When this is done there will be found, in almost every case, a deficiency, varying in amount according to the degree of skill employed, but never less than 7 or 8, and more frequently 11 or 12 per cent.; while instances are numerous in which as much as 24 per cent. of the volatile products is habitually lost. The following examples, which are, to a considerable extent, drawn, so to speak, from the life, are offered in confirmation of this statement.

No. 1 is an example of probably the highest return yet obtained, where coal only is employed, working in the ordinary way:

EXAMPLE No. 1.

Newcastle Coal Carbonized in London.

	lbs.
10,500 cubic feet of 16½ candle gas, specific gravity .461, weigh $\frac{10,500 \times 1,728 \times (31{\cdot}012 \times {\cdot}461)}{7,000 \times 100}$	370·56
10 gallons of tar, at 11·2 lbs. per gal....	112·00
10½ gallons of liquor, at 10·2 lbs. per gal....	107·10
Impurities—	
Sulphuretted hydrogen taken out, say ¾ per cent. $\frac{78{\cdot}75 \times 1,728 \times 36{\cdot}33}{7,000 \times 100}$	7·06
Carbonic acid taken out, say 2½ per cent. $\frac{262{\cdot}5 \times 1,728 \times 47.26}{7,000 \times 100}$	30·62
Ammonia removed after condensation, say 12 gallons, 10 oz. liquor; ammonia, 40 oz., $\frac{12 \times 10 \times 17}{49}$ oz.	2·60
Total volatile products	629·94
Coke, say	1,560·00
Total	2,189·94
Leaving a deficiency of	50·06
	2,240·00

Or $\frac{50{\cdot}06 \times 100}{629{\cdot}94}$ = 7.94 per cent. of the volatile products.

The second is what may be termed a medium example:

EXAMPLE No. 2.

Inland Coal.

9,400 cu. ft. 17 candle gas, sp. gr. ·468, weigh $\frac{9,400 \times 1,728 \times (31{\cdot}012 \times {\cdot}468)}{7,000 \times 100}$	336·78
11 gallons of tar, at 11·2 lbs. per gal....	123·20
16 gallons of liquor, at 10·2 lbs. per gal....	163·20
Impurities—	
Sulphuretted hydrogen taken out at purifiers, say 1½ per cent. $\frac{141 \times 1,728 \times 36{\cdot}33}{7,000 \times 100}$	12·64
Carbonic acid taken out, say 2½ per cent. $\frac{237{\cdot}5 \times 1,728 \times 47{\cdot}26}{7,000 \times 100}$	27·70
Ammonia removed in scrubbers, say 15 gallons of 12 oz., $\frac{15 \times 12 \times 17}{49}$ oz..	3·90
Total volatile products	667·42
Coke, say	1,500·00
Total	2,167·42
Leaving a deficiency of	72·58
	2,240·00

Or $\frac{72{\cdot}58 \times 100}{667 \times 42}$ = 10·87 per cent. of the volatile products.

And the third is from the bottom of the class:

EXAMPLE No. 3.

	lbs.
8,300 cu. ft. 17½ candle gas, sp. gr. ·480, weigh $\frac{8,300 \times 1,728 \times (31{\cdot}012 \times {\cdot}480)}{7,000 \times 100}$	304·99
11 gallons of tar, at 11·2 lbs. per gal....	123.20
13 gallons of liquor, at 10·2 lbs. per gal....	132·60
Impurities—	
Sulphuretted hydrogen taken out at purifiers, say 1½ per cent. $\frac{124{\cdot}5 \times 1,728 \times 36{\cdot}33}{7,000 \times 100}$	11·16
Carbonic acid taken out at purifiers, say 2½ per cent. $\frac{207{\cdot}5 \times 1,728 \times 47{\cdot}26}{7,000 \times 100}$	24·20
Ammonia which should be removed, but more frequently left in, $\frac{15 \times 12 \times 17}{49}$ oz.	3·90
Total volatile products	600·05
Coke, say	1,500·00
Total	2,100·05
Leaving a deficiency of	139·95
	2,240·00

Or $\frac{139{\cdot}95 \times 100}{600{\cdot}05}$ = 23·32 per cent. of the volatile products.

In calculations of this kind it is not easy to be strictly accurate, but I have endeavored to avoid under-estimating the weight of any single product, so as not to fall into the error of over-estimating the deficiency. Where this is as high as in No. 3, the remedy is doubtless to be found in the employment of an exhauster, which is yet a stranger in very many works, and by the aid of which the loss need never exceed 10 or 11 per cent., while, beyond this, a fur-

ther improvement is practicable by careful attention to the condition of the retorts; but, however well made clay retorts may be, they are always, to a certain extent, porous; and however well they may be set or built, their soundness is of very short duration. Consequently it is not to be wondered at that a large proportion of the gaseous matter, which it is our object to secure, finds its way, not up the ascension pipes, as we would have it, but through the flues and up the chimney stack, at the top of which, especially if the stack be a short one, its presence is generally indicated by a body of flame more or less considerable. If any one be disposed to question the origin of this flame, which has, indeed, been attributed to wasteful firing, let him try the experiment for himhimself of removing all pressure from the retorts, when the simultaneous disappearance of the flame will afford convincing proof of its identity with the gaseous matter produced in the interior of the retort.

Another circumstance, pointing conclusively to the mischivous tendency of pressure, is the formation of carbon, which without doubt, may be regarded as its natural consequence. Viewed in this light, it may be accepted as no slight proof of the advance that has recently been made in the direction of obtaining fuller value from the coal—that much less is now heard than formerly of the difficulty experienced in scaling retorts, or of the various remedies which ingenuity has devised for getting rid of this troublesome product. It is abundantly manifest that, in regard to this, Gas Managers have it in their power to lend conspicuous illustration to the proof of the proverb, "that prevention is better than cure."

It may, however, be taken for granted that with the dip-pipe, however carefully it is adjusted, a certain amount of pressure is unavoidable; and, inasmuch as even this minimum pressure is to be deprecated, the question which forces itself upon our attention is, whether or not is the dip-pipe a necessity? It may without difficulty be conceded that, if with the highest state of efficiency can be united the greatest possible security and convenience, such a combination is by all means to be promoted and maintained; but when this involves, as in the case before us, the sacrifice of a certain degree of efficiency, we have a perfect right to question its wisdom, and to ask ourselves whether it is worth the cost entailed. Suppose an account were to be regularly rendered to us at the rate of, say, 10d. or 1s. per annum for every ton of coals carbonized, should we not require to write "value received" before passing it for payment? And yet it is very certain that, indirectly, most of us do pay this, and more, year after year, without inquiry or remonstrance, for the use of the dip.

It may, however, be fairly urged that when, by careful attention and periodical adjustment, this inevitable loss is reduced to its smallest dimensions, we do get value for what remains, in the shape of the unquestionable convenience and absolute security which the dip ensures; and the argument would be conclusive if it could at the same time be shown that such conditions are indispensable to successful working, or that they cannot be sufficiently approximated by other means less open to objection on the score of pressure. Many, indeed, there must be who entertain the belief that such is the case, for otherwise it is impossible to account for the almost universal employment of the dip. But of these I would inquire, Have you satisfied yourselves, by personal experience of other systems, that the dip is really indispensable? Unless this question can be answered in the affirmative, it would seem impossible to account for its retention upon any other supposition than that there exists a widespread theoretical assumption of its value; which may be said to savour too much of a blind adherence to custom to entitle it to much respect. And if it be objected that no convenient substitute for the dip has been devised, I need do no more than refer to the example of Cheltenham, where, under successive Managers, the dip has for many years been unknown. The success which has there attended its abandonment seems to point incontestably to the conclusion that, thanks to the introduction if the exhauster, the necessity for its retention has long since passed away.

Intimately associated with this question is the consideration of the effect produced by forcing the gas, as it is generated, through the tar in the hydraulic main. The writer is not in a possition to express any positive opinion with regard to this; but it seems highly probable, from the observations of Mr. R. H. Patterson and others, that its contact with tar has the effect of depriving gas of some of its illuminating constituents. At the same time, it is to be observed that the subsequent washing or scrubbing process is an ordeal scarcely less searching in its effect upon the hydrocarbon vapors than that which it would escape by the non-use of the dip; so that, in the absence of proof, it may be safest to omit from the calculation any advantage that might be possible in the direction of an increased illuminating power.

Following next in point of order comes the loss incidental to distribution. Of that which, being due to defective registration, is apparent only, it is unnecessary to say more than that it is remediable almost to the smallest fraction, as the recent experience of the Chartered Company, if it stood alone, would suffice to show, but which experience is abundantly confirmed by that of others in all parts of the country. So large a percentage of unaccounted-for gas as 25, 20, or even 15, may be said to point to an indifference on the subject of correct measurement which, in ordinary commercial transactions, would be regarded as simply intolerable, while in the gas manufacturer it is, to say the least of it, somewhat discreditable. Nor can the imperfections of the meter, such as they are, be pleaded in extenuation of such a fault, it being clearly upon record that these are completely under control, rigid supervision being all that is needed to secure, within practical limits, accurate registration.

While it may without difficulty be admitted that the principal sources of actual waste incidental to distribution are leaky gasholders, bad joints, and worn-out services, all of which it is within the power of the Gas Manager to remove, it is without doubt an open question as to how far such waste is susceptible of diminution, since a certain proportion is always due to accidental breakages of mains, or to other causes over which the Gas Manager possesses only a limited control. But even such proportion must be regarded as only in a lesser degree preventable, when it is remembered how much can be effected by means of improved arrangements. For instance, the damage done to mains, by heavy traffic or unequal subsidence, may be minimized by laying them deeper under the ground, and by the employment of larger pipes—small and weak ones, such as 2 inches and 3 inches, being very much more liable to injury than such as are made of heavier mettle. In like manner wrought-iron service-pipes may be preserved by coating them with asphalt, or rendered more durable by the adoption of a thicker gauge of iron in their construction. Again, almost absolute immunity from loss from this source may be ensured by the employment of lead pipes, while according to some wrought-iron tubes that have been subjected to Professor Barff's process are secure against oxidation for almost any length of time. Too much attention likewise cannot be paid to the jointing of service to main pipes, which, especially when the latter are thin, is a fruitful source of leakage. It has been said, with much show of reason, that there is no better evidence of the general character of the management of a gas undertaking than is afforded by the condition of the distributing plant, as shown by the percentage of unaccounted-for gas. But, however this may be, it is certain that in no other direction can the Gas Manager obtain a more sure and speedy return for the exercise of ordinary care and vigilance. Instances are numerous of a rapid improvement, under such conditions, to an almost unlooked-for extent. In the case of the late Birmingham Company, for example, the percentage of unaccounted-for gas was, in the short space of three years, reduced from 11 or 12 per cent. to about one-half that amount. All this points to the conclusion that, in this matter, as in others of a similar nature, there is no such thing as finality short of an almost total suppression of even the appearance of waste.

In expressing this opinion I am not overlooking the fact that loss may arise from the action of the law of diffusion of gasses, but that this can be anything appreciable, the nature of the material of which our mains and services are made precludes us from believing. A more important element of difference—for loss it is not—is to be found in the variable temperature between the works and the consumers' meters, every one degree of variation repcrepresenting a difference in volume of about one-quarter per cent. This difference is no doubt greatest when the works' registration is habitually corrected to 60°, because in the mains the gas is invariably cooler than this by several degrees; but it is probably never more than 1 or 1½ per cent., and by correcting to a temperature more nearly corresponding to that at which the gas passes through the mains and consumers' meters, it can, of course, be made to disappear altogether. Having regard to all the circumstances, it is impossible to doubt that almost perfect correspondence between the works and the consumers' meters is possible of attainment, and to this end our efforts should be directed. If our mains and services were laid and maintained, as they might be, almost absolutely gas-tight, we should place ourselves above the necessity for restricting day pressures as a means for diminishing leakage—a most important consideration when it is recollected that, in order to meet the requirements of an extended consumption for heating purposes, we must be in a position to maintain a moderately high pressure throughout the greater part of every 24 hours. If this constant service is to be provided with profit to the manufacturer, it will have to be free from the liability of waste.

The subject of gas-burners is one of recognized importance, and the prodigious loss for which they are directly responsible has very properly been a matter of frequent comment; but it is questionable whether the Gas Manager is to be found who considers himself personally accountable for the imperfect combustion of the gas which he supplies; and hence it is not improbable that objection may be taken to my including this amongst those sources of waste which it is within his power to control To a certain extent this objection is no doubt a perfectly valid one, although it would not be difficult to show that our influence, if we chose to exert it, must be very considerable indeed; but it is sufficient for my purpose very briefly to refer to the importance of the question as affecting our interests, present and future.

Within a comparatively brief space of time, our knowledge of the condition by which perfect luminous combustion may be secured has been greatly extended, with the result that the best constructed burners of the present day compare very favorably with their predecessors of say 20 years ago, being made to yield fully 40 per cent. more light with the same consumption of gas. Satisfactory as this may be, it is by no means pleasant to reflect that this improvement is profitless to the general body of consumers, in consequence of the almost universal retention, through ignorance, of the old and wastoful forms of burners; so that if the waste from this source alone were to be set down at 25 per cent., it would be found to be by no means an exaggerated estimate. In proof of this it may be mentioned that at the exhibition of gas-heating apparatus recently held in Birmingham, there was exhibited a series of burners, nearly all of them typical of such as are in daily use. On being tested it was found that the difference between the best and the worst was 20·41 against 6·92 candles, showing a loss by the use of the latter of no less than 65·7 per cent., while an ordinary Argand, considered to be a very good one of its kind, of which there are many thousands in use for

illuminating shop windows and similar purposes, gave only 13·42 candles, being a loss of 34·2 per cent.

In fairness to the gas, no less than from economical reasons, such a manifest abuse ought no longer to continue. Complaints of bad gas are freely made, which on investigation are usually found to be chargeable to the burner; but it is as a means of reducing the cost to the consumer that the importance of dealing intelligently with this question is most apparent. It may possibly be regarded as an incontestable proof of the incomparable vitality of coal gas that, notwithstanding such an amount of waste, it has not only stood its ground, but increased in popular favor; but have we any guarantee for the continuance of such good fortune? Are there not, on the contrary, at the present moment, signs of a disposition to dispute with us the occupation of a portion of our domains? We may, it is true, be very far from believing in the probable supercession of coal gas, speedy or remote; but with such disbelief, the endeavor to increase the distance between it and possible competitors is perfectly consistent. In making gas-light cheaper, whether by means of improved manufacture or by the reduction of the illuminating power at the burner, we are acting in accordance with the conviction that our interests as the manufacturers are practically identical with those of our consumers, than which no policy can commend itself as more likely in its effect to strengthen and confirm our position as the principal purveyors of the means of artificial illumination throughout the civilized world.

I have thus imperfectly referred to what appear to be three of the principal hindrances—for so they may be termed—to the further successful employment of coal gas; for it need hardly be said that, in proportion to its cheapness, so is its use likely to extend, more especially for heating purposes. In this latter direction the field for its employment would seem to be of almost limitless extent.

Mr. Chandler said he could confirm from observation every word in the paper just read. The former part of it referred particularly to that objectionable part of the apparatus connected with gas works known as the dip-pipe, and he might say there were other works besides those at Cheltenham which had proved to demonstration that prevention, with regard to the deposition of carbon in the retorts, was better than cure. He had in his mind's eye, just now, some works situated somewhere in Surrey, where patent dip-pipes had been fixed. Previously the make of gas was only a little over 8,000 feet per ton of coal carbonized; but after they were applied the make was increased considerably—he believed to over 10,000 feet. He attributed this entirely to the adoption of the patent dip-pipe; in other words, the removal of the seal in the hydraulic main. This caused a smile; but to what were they to attribute the extra make of gas, seeing it was exactly under the same conditions? This brought him to a remark of Mr. Hunt's, wherein he seemed to hint that the fact of doing away with the dip necessitated the use of an exhauster. But he repudiated that, because the dip-pipe was taken out of the tar or liquor in the hydraulic main, there was any necessity for the exhauster. It was only removing an impediment to the gas getting away into the gasholder, by lifting the dip-pipe from the seal in the hydraulic main. What was done by using an exhauster but releasing the pressure from the retort—the pressure which was given first by the seal in the hydraulic—on to the condensers, the scrubbers, the washers, the purifiers, the holders, and so on? The dip-pipe gave a half-inch pressure if there was a half-inch seal, and if that was removed it created no greater necessity for the adoption of an exhauster than if it was kept in a hydraulic seal. There were many present who had advocated doing away with a seal in the hydraulic main—Mr. Paterson, Mr. Newbiggin, and Mr. Livesey. No doubt there were some others who decidedly objected to it, but if they came to consider the matter it would be found that to remove the impediment to the gas getting away to the holder must be beneficial, if not in increasing the make, in preventing the deposit of carbon on the retorts.

Mr. Hepworth (Carlisle) said this subject was worthy of a broader basis than the bottom of a dip-pipe. On the general question of waste he spoke some time ago, but there was one point to which attention might also be profitably called, but to which Mr. Hunt had not alluded. He felt sure he had not forgotten its exisistence, but it was such a prevailing element of waste in many works that some special reference should be made to it. He had before him the analysis of the accounts of the Metropolitan Companies, and he noticed the consumption of coke for fuel varied from 21 to 33 per cent., and averaged 28. Now, 28 per cent., which was the average of the Metropolitan Companies, was a much lower average than prevailed in many places. Speaking generally on the subject of waste, as borne out in the analysis he had before him, he wight say there could be no more profitable occupation of leisure time than for some present to go through these figures and compare them with their own working. He was sure they would find abundant room for checking and preventing waste which was going on in their own establishments.

Mr. Woodall (Leeds), referring to the statement of Mr. Chandler that where a patent dip-pipe was introduced the yield rose frome 8,000 to 10,000 feet of gas per ton of coal, though no exhauster was used, said a dip did not necessarily involve a greater pressure than half an inch. But the gasholder could hardly be supposed to show a smaller pressure than 2½ inches; so that the weight of the gasholder would be five times that of the dip, as represented in the retort. Now, if one gained 2,000 feet per ton by the removal of the half-inch pressure of the dip, clearly, by the removal of the weight of the gasholder, one would get a great deal more. This was a plain case, because if an exhauster were used the pressure must be equal throughout the apparatus.

Mr. Mead (Sutton) feared Mr. Chandler had attempted to make out too good a case. He also had visited some Surrey gas works, and in one case found 18 inches of pressure against the retort; and possibly others present might remember works where there was something like that. In works he had to deal with he endeavored to remove the whole dip and let the gas pass freely through, and the difference was from 300 to 400 feet per ton of coal carbonized.

Mr. Methven (London) said a previous speaker had referred to figures in Mr. Field's analysis of the London Companies' accounts as to the quantity of coke used for fuel. But in comparing the percentage in Mr. Field's book they must take into consideration also the quantity of coke per ton made, which might not come out to the percentage used for fuel. In some cases the companies only gave credit for making 33 bushels per ton, and in others, 36. That ought to be considered where they compared the consumption for fuel.

Mr. Paterson (Cheltenham) said the mention of the exhauster reminded him of a circumstance connected with the yield of gas, or the loss of gas by the deposit of carbon in a retort, which had not been as yet mentioned—the oscillation or drawing through the dip in the hydraulic main; because with all mechanical exhausters there is a certain amount of oscillation. The gas could not be drawn away perfectly continuously from the retorts, but there was what was called a pulsation. However, in Cheltenham they had a steam-jet exhauster in action, and there the work of exhaustion was carried on so steadily that there was no oscilation at all. The gauge on the tap was so steady that, unless some means were taken to increase the pressure or otherwise, it would appear that it was stuck. It was said that the removal of the dip did away with the loss of gas from leakage through the pores of the retort, and the destruction and the deposition of carbon on the material of it. The removal of the dip, unless something else was removed, would do nothing of the kind; and in the case referred to by Mr. Chandler, another element came into calculation. It was utterly impossible that the removal of the dip of itself, although it was 5 inches, would give a difference between 8,000 and 10,000 feet per ton under the same conditions as to coal, temperature, and so on. They ought not to be content with even 10,000 feet, for in their experiments they could get gas to the extent of 10,500, 11,000, and 11,500 feet per ton. It was quite clear, therefore, that the gas was in the coal, and that their effort should be to get it out, and if possible to store it up, and—to carry it on further—get paid for it. The way Mr. Hunt had taken up the question and worked it out was likely to result in very great good. He did not like to give results, but since Cheltenham had been referred to, he might say that they had lately carbonized about 100 tons of coal a day. Of course, their mains were by no means puny, but from that 100 tons of coal they had no difficulty at all, day after day, in realizing from 10,000 to 10,800 feet of gas per ton. That was a large yield of gas, and, were he not able to give another fact, he should hesitate in asserting it; and, unless they got paid for a fair quantity, he should say that there was something wrong in the estimate, but, seeing that for last year they had got paid for 10,300 feet per ton, he had little hesitation in stating that they did in reality get that yield. There was not much difference in coal, provided it was of fair quality. Then there was the question of leakage, which Mr. Hunt had carefully gone into, and he had given the preference to lead services. He (Mr. Paterson) did not know whether it was the fact or not, but in his experience in towns where lead services were universally adopted, there the leakage was much less than where iron was used.

Mr. Peebles (Edinburgh) wished to allude to a point which Mr. Reid drew attention to some time ago, which might account for some portion of the gas which was not accounted for—namely, that, while all the experiments on the illuminating power of gas were made at a temperature of 60°, the gas was oftentime sold at a temperature of 30°. Mr. Reid some time ago drew the attention of Gas Engineers to this fact, through the medium of the *Journal*, but he had not seen it noticed since. In hard winters there must be a great deal of gas sold at a temperature of 30°, but the illuminating power of gas was tested in the laboratory at 60°. Those who had continued the tests over three or four months must, in the result, have a discrepancy in the gas as delivered from the station-meter, which very likely might be at a high temperature compared with the meters of consumers, which were often placed in cellars and other places at a low temperature. This might, in some degree, account for the quantity lost.

Mr. Hunt, in reply, said the course the discussion had taken turned almost entirely on the use of the dip. As one gentleman had pointed out, Mr. Chandler had attempted to prove too much in estimating at 2,000 feet the gain from the use of the patent dip. It seemed to him almost impossible to gain anything by it, unless an exhauster were also employed, because the pressure of the gasholders and other apparatus must inevitably be thrown on the retorts. The use of the exhauster was simply to relieve the retorts of that pressure. Mr. Hepworth had referred to the fuel account as being exceptional in some instances. Although the title of his paper was somewhat general, it was not his intention to include in it every sort of waste in and about gas works, or he should not have overlooked that question. He might say, however, in comparing the returns with those published by the Metropolitan Companies, that he believed, as a rule, those Companies estimated the use of their coke, and took their make to be uniformly 36 bushels per ton. As a fact, many coals produced a much larger quantity, so that, in some instances, the fuel account was put lower than it should be. Mr. H. Woodall had referred to the dip not necessarily throwing more than half an inch pressure on the retort, and certainly, if the seal were accurately adjusted at half an inch, and

if the water were always maintained in the hydraulic main, it would remain so; but it must be recollected that the hydraulic main speedily became filled with tar, which was of a viscid nature, and consequently threw much more pressure on the retorts than was apparent. Mr. Paterson had very rightly referred to the question of what could be got out of coal by experimental works. He found by repeated experiments that the coal which produced in practice 9,400 feet per ton of 16½-candle gas, could be made to produce, on an experimental scale, fully 11,000 feet of 17-candle gas. That seemed to him to be a difference which ought not to exist, and they ought, as Mr. Paterson had said, to aim at producing on a working scale what they were able to do in the laboratory. With reference to Mr. Peebles's observation as to temperature, he must point out that at the works the measurement was at variable temperatures. If the gas were properly condensed, it brought down the temperature nearly to that of the atmosphere at the works. He would remind Mr. Peebles that 30° was two degrees below freezing point, and if they used wet meters, that would necessitate thawing them before the gas could pass through them. It was therefore too low a temperature to take.

Mr. Peebles said he only mentioned 30° as an illustration.

[To be continued.]

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—Ed.

Engineer's Office, Gas Works, Foot G. St.,
Washington, D. C., Sept. 6, 1878.

Mr. Editor:—You doubtless have seen accounts in the daily papers of several severe wind and rain storms that visited this city on the 5th, 6th, and 10th of August, and doing a vast amount of damage to property.

The storm that took place on the 10th (Saturday), about 2 o'clock, was a tornado of tremendous force, but was quite limited in its scope. It came, however, in the line of our purifying house, and with the determination to convince all who might see its effects, of its power, because it struck the north wall, dividing the lime house from the purifying house, doing much damage to the house, and breaking and twisting the immense iron roof as though it had been wire, and moving the entire roof about one foot in an opposite direction.

The wind struck the building as though shot from a cannon, taking the entire end out, and leaving the side walls in perfect condition.

The loss will be about $3,000, aside from the inconvenience, annoyance, and demoralization that such misfortune brings in its train. Fortunately, no one was seriously hurt.

Corrosion of Boilers by Smoke Deposits.—An English paper says: "When smoke deposits on boiler surfaces distant from the furnace are rendered moist by any accidental cause, the sulphurous acid in the gases of combustion determines the attack upon metal by the formation of the sulphate of the oxide of iron. The attack can take place while the boiler is in use, on such of its metalic surfaces as may be wetted by leakage from the boiler itself, or by water infiltrated through the masonry, or derived from the condensation of the aqueous vapor in the gases of combustion by contact with surfaces relatively cold. It can also be produced while the boiler is out of use by means of the humidity of the air in the flues. The different origins of the corrosive action point out the precautions to be taken for preventing its destructive effects. They are only those which should be adopted for the preservation of any apparatus, namely, careful construction, thorough cleaning and maintenance in good repair."

Analysis of Lamp-Black.

MADE FROM THE NATURAL HYDROCARBON GAS OF THE OHIO PETROLEUM REGION.

By J. R. Santos.

This material is described in the following passage from my portion of the "Report of the Judges on the Philadelphia Exhibition of 1876." (Group III., Chemical Manufacturers):—"One of the more interesting among the minor American exhibits consisted of the fine lamp-black which has for about two years past been made at Gambier, Ohio, by imperfect combustion of the natural gas which occurs throughout the petroleum region, and which frequently escapes in such quantity from borings, yielding little or no mineral oil, as to give rise to the term 'gas-well.' There are two such wells in Knox County, Ohio, near the junction of the Kokosing and Mohican Rivers, affording very large quantities of hydrocarbon gas, which Mr. Peter Neff, of Gambier, has utilized in the manufacture of lamp-black, which he calls 'Diamond Black. He has patented and uses several kinds of apparatus for burning the gas [of which two are described and figured in the Report]. In the building used, 1,800 burners are at work, consuming about 275,000 cubic feet of gas per twenty-four hours, being about one-fourth of the available supply. The composition of the gas by volume is given as—

Marsh gas	81·4
Ethyl hydride	12·2
Nitrogen	4·8
Oxygen	0·8
Carbon monoxide	0·5
Carbon dioxide	0·3
	100·0

"No mention is made of free hydrogen, though from the experiments of Prof. Sadtler on samples of natural gas from Western Pennslyvania, it probably is present in small quantity. The lamp-black is at present manufactured to the extent of about 16 tons per annum. It is very fine and smooth, free from gritty particles, and of an intense blue-black color. The absence of oily matter is very strikingly shown by mixing it with water. Although from the large amount of air in the mass of loose powder most of it floats at first upon the surface, stirring soon mixes it in large quantity with the water, rendering the whole black and opaque. In this behavior it contrasts strongly with common lamp-black. It does not color ether, and the liquid, when evaporated, leaves but a trace of residue, while ordinary lamp-black, presumably from rosin, gives a deep yellow solution, leaving an orange-brown tar on evaporation. On burning a quantity of the diamond black sufficient to fill a large platinum dish, a barely visible trace of ferruginous ash was left, derived, no doubt, from the scrapping of the metalic surfaces (on which the material was deposited and collected). This material is sold to makers of fine printing and lithographic ink in the United States, and has been sent in small quantity to Europe. It deserves to become more widely known."

I have used this lamp-black for a number of laboratory purposes requiring an artificial form of carbon of very high degree of purity. Mr. Santos has analysed it, with the following results:—

Sp. gr. at 17° C., after expulsion of air, equals 1·729. The air-dried lamp-black lost by exposure at ordinary temperature over sulphuric acid 2·30 per cent. of moisture, and a further loss of 0·40 per cent. was experienced by heating to 130° C. Continued heating to 200°, and then to 300°, under atmospheric pressure, gave rise to no further loss, but a minute amount of water was expelled by subsequently heating in a Sprengel vacuum.

The material, dried at 200° C., gave in two combustions—

	I.	II.
Carbon	96·041	96·011
Hydrogen	0·736	0·747

The occluded gases, driven out by heating to low redness in a Sprengel vacuum,* represented, on calculating weight from volume—

Carbon monoxide	1·378	p. c. by weight.
Carbon dioxide	1·386	" "
Nitrogen	0·776	" "
Vapor of water	0·682	" "

There was also expelled and condensed on the cooler part of the tube, 0·024 of a solid light yellow hydrocarbon, soluble in alcohol, fusible, and volatilising rapidly under atmospheric pressure between 215° and 225° C. (impure naphthalene?)

Hence the composition of the lamp-black may be calculated as—

Carbon	95·057	†
Hydrogen	0·665	†
Nitrogen	0·776	
Carbon monoxide	1·378	‡
Carbon dioxide	1·386	‡
Water	0·682	
Ash (Fe_2O_3 and CuO)	0·056	
	100·000	

—*Chemical News.*

The Western Gas Managers' Association.

A meeting of Gas Works Managers and Engineers in the Western States is to be held in St. Louis, Mo., upon the days of the 18th and 19th of September, 1878, for the purpose of organizing the "Western Gas Managers' Association." A cordial welcome will be extended to visitors by the Gas Managers of St. Louis.

Executive Department, Mayor's Office,
St. Louis, Sept. 5, 1878.

J. O. King, Esq.:

Dear Sir:—Understanding that false rumors and hurtful statements of the prevalence of yellow fever in our city are likely to influence the contemplated meeting in St. Louis of Gas Managers and Engineers, permit me to contradict most emphatically such an erroneous idea, and to state that we have never had and have not now a single local case of yellow fever. Our sanitary conditions and regulations are of such a character that it is beyond the bound of possibility for any epidemic to originate or thrive here. All refugees from infected districts are not permitted to enter or remain within the city limits, but are treated at our quarantine station, twenty miles below the city.

Respectfully,
Henry Overstolz,
Mayor and Pres. Board of Health.

Attest,
Richard Walsh, Register.

Ammonia Versus Malaria.

The Augusta (Ga.) *Chronicle* says: "The Georgia Chemical works, which are of a very extensive character, and manufacture annually large quantities of commercial fertilizers, are situated in the southern suburbs of the city, on South Boundary Steeet. This portion of the city is low and damp, and the people living there had always been subject to chills and fever and other malarial diseases. We say *had* been subject, for yesterday morning Mr. Lowe, of the chemical works, informed us that the works had exterminated malaria in their neighborhood. He contended that since the company commenced operations it had routed chills, &c.; and that persons living near there who once suffered a great deal, suffer now on South Boundary no more. The effect of the works on the health of the country adjacent had been as marked as it had been beneficial. There could be no doubt as to the cause of the change. A practical test had been applied in the buildings of the company. Men had been employed there who were ague shaken and fever fired, but who, in a comparatively short time, were entirely relieved of the companionship of their malarial friend. The theory is that the ammonia does the business. The *Chronicle* did not stop to ask whether the people of the vicinity preferred ammonia to malaria, taking it for granted they did.

* See similar results obtained by Wright and Luff for carbon prepared from sugar and from carbon monoxide—*Chem. Soc. Jour.*, Jan., 1878, pp. 18 to 20.

† Including the C and F of 0·024 solid hydrocarbon.

‡ These gases were doubtless partly formed from solid carbon and occluded oxygen by the heat applied in vacuo.

Gas-Light Intelligence.

OUR EXCHANGES.

United States.

[*Engineering News.*]

THE PRICE OF GAS has been reduced in Oswego, N. Y.

THE GAS WORKS at Marion, Ind., were expected to be completed last week.

A BOSTON GAS COMPANY is negotiating to put in gas works at Decorah, Iowa.

A FORTY-YEAR OLD gas pipe was dug up in Maiden Lane, New York, lately, and though very rusty, it was not otherwise defective.

THE BOSTON GAS COMPANY distributes a larger amount of gas per mile of pipe main than any other company in the United States.

THE GAS WELLS of Beaver Falls, Pa., yield 100,000 feet of gas every day. The gas, because of its unusual purity, has been employed in a saw-tempering establishment.

INDIANAPOLIS has reached an agreement with its gas company, by which the streets are to be lighted 2,600 hours during the year from August 1, for $55,000, the number of lamps in the city to be reduced from 2,800 to 2,160. The company had offered to light them all 1,800 hours for $59,600, but the City Council would only give $55,000, and now gains its price but loses 640 lamps.

THE SPRINGFIELD (ILL.) *State Gazette* says: "The matter of lighting cities by means of coal oil lamps, instead of gas, is being agitated in a number of places, and is attracting considerable attention. We are inclined to think that when a city finds itself unable to light its streets with gas, it is about time to sit in darkness. Wherever we have seen coal oil used for the purpose, it has simply served to make the darkness visible—nothing more."

BALTIMORE thinks of introducing an electric street-lamp lighter, which it is thought will save enough gas to pay for itself in a short time. In addition to the pipe containing the gas, another pipe, containing the battery wire and compressed air, is necessary. The air is compressed at the central office, and being forced through the pipe connects the poles of the batteries in the various lamps, turning on the gas and at the same time generating an electric spark, which ignites it. The cost of attaching the apparatus, including the instrument, the pipe, and the labor, has been computed to be about $40 each.

THE DETROIT *Evening News* has the following: "We cautioned the Detroit gas companies long since that the temper of the times would not submit to extortionate prices, and so it has proved. The city is to-day using naptha successfully in its street lamps, while the number of families who are employing kerosene, even where they could use gas, is very large. The true policy of the gas companies would have been to have saved their custom by contenting themselves with moderate profits, without attempting just now to make up their past losses. Thinking, however, that they had a firm grip on the public, and could charge just what they pleased, they have overshot the mark, and have destroyed a custom that it will be very difficult to recover, for it is just such contingencies as the present which stimulate the perfection of electric lights and other similar inventions. It is quite possible, therefore, that unless the gas companies see their mistake and come down with very liberal terms, the streets of Detroit may never again be lighted with coal gas."

OUR READERS in this town will do well to note the communication from the secretary of the Derby Gas Co. Kerosene and other oils crowd hard on the gas companies, as we suppose, everywhere in these days; but, after all, gas is the royal light, and none will be without it who can afford it. No complaint has ever been made against the quality of the Derby Company's gas, and this communication would seem to show that no complaint shall be made against the price. In February, 1872, this company started with gas at $4 per thousand feet; January 1, 1875, the price was reduced to $3.50; November 1, 1876, it was again reduced to $3; and here now it is reduced by this last offer to $2.50, a price lower than other cities, and such as would seem to bring it within the reach of all. Their notice, we trust and believe, will increase the consumption of this very popular light among us.

To the Citizens of Derby:—The Directors of the Derby Gas Company have decided to reduce the price of gas from Sept. 1, as follows:

The bills will be made out as at present, $3.10 per thousand feet. If the bills are paid by the 10th of the month, a discount will be made of ten cents a thousand where the consumption is less than one thousand feet for the month, and sixty cents per thousand where the consumption is one thousand feet or more. In other words, those who pay promptly will receive their gas at $3 per thousand, if their consumption is less than one thousand feet per month, and at $2.50 if it is greater. By this reduction the Directors believe that gas will be sold in Derby at a lower rate than any town or city in Connecticut, and they trust that you will deal with the gas company in the same liberal spirit that they have shown by this and former reductions.

CHAS. H. NETTLETON,
Sec. Gas Co.

—*Derby Transcript.*

THE CANNELTON COAL COMPANY, at Cannelton, W. Va., is running on full time, with a full complement of workmen.—*American Manufacturer.*

Value of "Waste Products."—"Here is an illustration," says the Manchester (Eng.) *Textile Manufacturer*, "of the value of so-called 'waste products.' The Bradford Corporation lately accepted the tender of Mr. Steuart, of Manchester, offering £10,359 per annum for seven years for the ammoniacal liquor produced at the local gas works. The price paid under the expiring ten years' contract was £800 per annum. The holder of this contract was among the competitors for the new contract, and his tender was not £800 but £8,000 a year. The discovery in the liquor of a certain chemical substance used in aniline dyes has greatly enhanced its value."—*Western Manufacturer.*

Ammonia in the Kitchen.—The pantry shelves are getting grimy, or finger marks around the door-latches and knobs are looking dark and unsightly. For lack of time they are left day after day, for it is hard work to scour all the time, and it wears off the paint too. The husband keeps his bottle of oil, or perhaps a large can holds it, for he never stints in that Now, suppose his wife has her bottle of spirits of ammonia to use; she takes her basin of water and a clean cloth, just puts in a few drops of the fluid and wipes off all the dirt; it is worth more than a half day's labor, and does not hurt the paint either. She could put a few drops in her dish-water and see how easily the dishes could be cleaned; a few drops on a sponge would clean all the windows in the sitting-room, making them shine like crystal. It would take the stains off the teaspoons; and a teaspoonful in the mop-pail would do more toward washing up the kitchen floor than ten pounds of elbow grease applied to the mop-handle. A housewife has just as much right to make her work easy and expeditious as her husband has. If she does not do it, the fault is her own in a great measure:—*San Francisco Weekly Bulletin.*

Treating Belts.—A writer in the *Polytechnische Notizblatt* recommends the application of a good linseed-oil varnish to leathern, hempen or cotton driving belts when they are new, and its repetition every few months while they are in use. This not only tends to preserve them, but also prevents their either stretching or shrinking with variations of temperature, so that they never sit too tight or too slack when at work. When thus treated they remain quite as supple as unvarnished belts, and are less liable to slip. A similar treatment of shoe soles is recommended, as it renders them water-tight.—*Mining and Scientific Press.*

Prices of Gas Coal.

Waverly Youghiogheny	5.25	
Moore's "	5.50	
Shafton	5.35	
Despard Marion	5.15	
Newburgh Orrel	@	3.85 at Baltimore.
Murphy Run	5.25	
Chesapeake and Ohio Agency Coal	5.25	4.00 at Richmond.
Newcastle	3.75 @ 3.85	
Provincial	4.15 @ 4.50	
Cannelton Cannel	10.00	
Iuce Hall	8.00	

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks,
(with W. B. Scott & Co.,)
24 PINE STREET, NEW YORK CITY.
SEPTEMBER 16, 1878

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid.	Asked.
Gas. Co.'s of N. Y. City.				
Central	466,000	50	—	80
Harlem	$1,850,000	50	70	75
Manhattan	4,000,000	50	185	190
Metropolitan	2,500,000	100	130	135
" Scrip	$1,000,000	...	72	75
Mutual	5,000,000	100	73	76
" Bonds, gold.	900.000	1000	—	105
Municipal	1,000,000	100	95	100
New York	4,000,000	100	90	95
Northern	270,000	50	—	100
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	147	158
Citizens	1,200,000	20	73	80
" Scrip	320,000	1000	95	97½
Peoples	2,000,000	10	25	35
" Bonds	$ 325,000	...	--	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	60	67
Nassau	1,000,000	25	--	78
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	80	85
" Scrip		...	95	97
Kings Co	200,000	100	—	90
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	80	90
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md.	2,000,000	100	134	134
" Ctfs., gold	1,000,000		106	110
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80

NEWCASTLE AND PROVINCIAL GAS COALS.

THE UNDERSIGNED ARE PREPARED TO EXECUTE ORDERS FOR

NEWCASTLE COAL (NEW PELTON),

ALSO FOR THE BEST QUALITIES OF

PROVINCIAL GAS COAL,

DELIVERED AT ANY PORT IN THE UNITED STATES.

We supplied nearly 100,000 tons of Provincial Coal to some twenty-five different Gas Companies in 1877. These coals will yield in practical use fully

10,000 Cubic Feet of 16 1-2 Candle Gas---40 Bushels Coke.

JAMES D. PERKINS.
F. SEAVERNS.

PERKINS & CO.

45 SOUTH STREET, NEW YORK.

Citizens, Newark.....	918,000	50	100	105
" " Bds.	124,000	—	105	107
Chicago Gas Co., Ills			150	
Cincinnati G & C Co				190
Derby of Conn.....	160,000	100	60	80
East Boston, Mass..		25	132	---
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind.....		100	...	—
Hannibal, Mo.....	100,000	100	95	100
Hartford, Conn.....	700,000	25	184	186
Hempstead, L I.....	25,000	100	...	—
Jersey City	386,000	20	150	155
Jamaica, L. I.....	25,000	100	...	—
Jacksonville, Ill.....	120,000	50	82	...
Lewistown Maine...	400,000	100	70	80
Lima, Ohio,.....	60,000	100	—	...
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	100	110
Long Branch.....		20	40	50
New Haven, Conn...		25	160	—
Peoples, Jersey City		...	106	110
Peoples of Albany...	650,000	100	10	17
" Bonds	350,000	1000	--	-
Peoples of Baltimore		25	51	52
" Bonds....			106	—
Plainfield, N. J.....	80,000	100	—	105
Perth Amboy		25	—	95
Rochester, N. Y.....		100	50	60
Woonsocket, R. I....	150,000	100	95	...
Halifax N. S.....	400,000	40	148	150
Hamilton, Ontario...	150,000	40	117½	
San Francisco Gas-Co., S. Fr'isco Cal.			93	94
St. Louis, Missouri..	600,000	50	73	75
Stillwater, Minn.....	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
Troy, Citizens.....	600,000	100	—	60
Toledo, Ohio.....			95	97
Washington, D. C...		20	230	240

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FOR SALE.

A SET OF

Four 6x10 Purifiers,

With 8 in. Dry Center Seal and 8 in. Connecting Pipe.

Price, $500.

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We would solicit an order, feeling sure that a promotion of knowledge among the public generally of the ease and comfort of Gas, in its many uses, will increase the demand, and largely repay the small cost of distribution.

We will print with your imprint, and with such alterations as you may wish, in any quantity at the following rates:

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1000 . . .	35
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Single copies 10 cents.

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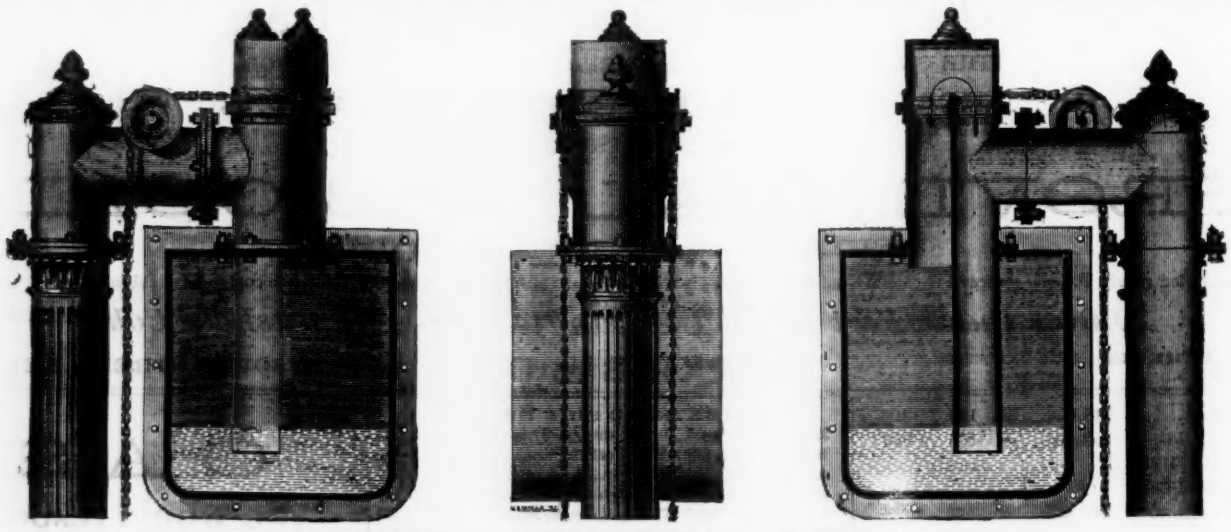

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WILLIAM FARMER may be consulted upon all matters relating to the Manufacture of Illuminating Gas. Will furnish Specifications, Drawings, and Estimates for the Erection of Gas Works of any Capacity, and will erect the same either on Commission or by Contract.

Having made the Construction of Gas Works a Specialty, perfect satisfaction can be guaranteed.

Sole Agent for the FOULIS HYDRAULIC MACHINE for Drawing and Charging Retorts.

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PATENTEE OF THE FOLLOWING INVENTIONS.

EXHAUSTER (Screw Propeller) for Gas or Air, and Condensation. **DUMPING BARROW** for Wheeling Coal, Coke and Lime, Etc. **HYDRAULIC MAIN** for Reducing Pressure on Retorts. **ZIGZAG SCRUBBERS** for Naphthalizing the Gas and Removing the Tar, Ammonia, and Naphthaline. **BYE-PASS DIP PIPE** for reducing the Pressure on Retorts, Etc., as per cut above. **SELF-ACTING WATER DISTRIBUTOR** for Scrubbers and Washers, Etc. **MOVABLE DIP PIPE** for Reducing and Equalizing the Pressure on Retorts. **TOWER SCRUBBERS** (Jacketted) for Economizing Space and Building Material. **DUPLEX CENTRE SEAL** for Keeping all the Boxes in a set continuously in action.

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FOR THE

CITY OF LONDON GAS CO.,

ONTARIO, CANADA.

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can learn of one by addressing the office of this Journal A permanent situation more desirable than a large salary. Can furnish the very best of New York and New England references. 457—3m

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Three dollars.

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351-1y

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
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CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

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It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

224-1y n

THE DESPARD COAL COMPANY
OFFER THEIR SUPERIOR
DESPARD COAL

To Gas Light Companies throughout the country.
Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y.
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Wharves Locust Point, } Baltimore.
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Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine

*** Reference to them is requested. 204-

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The partnership heretofore existing between the undersigned, under the style of *PERKINS & JOB*, is hereby discontinued by mutual consent.

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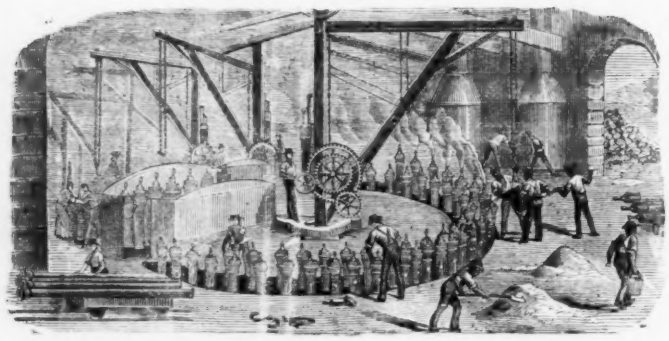

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DAILY CAPACITY 125 TONS.

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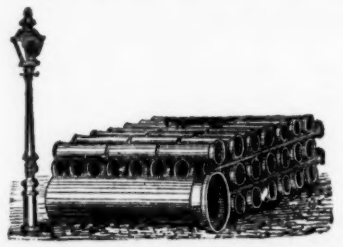

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SELLER'S CEMENT
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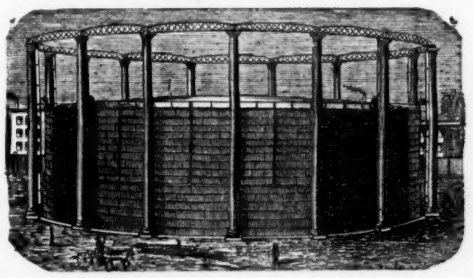

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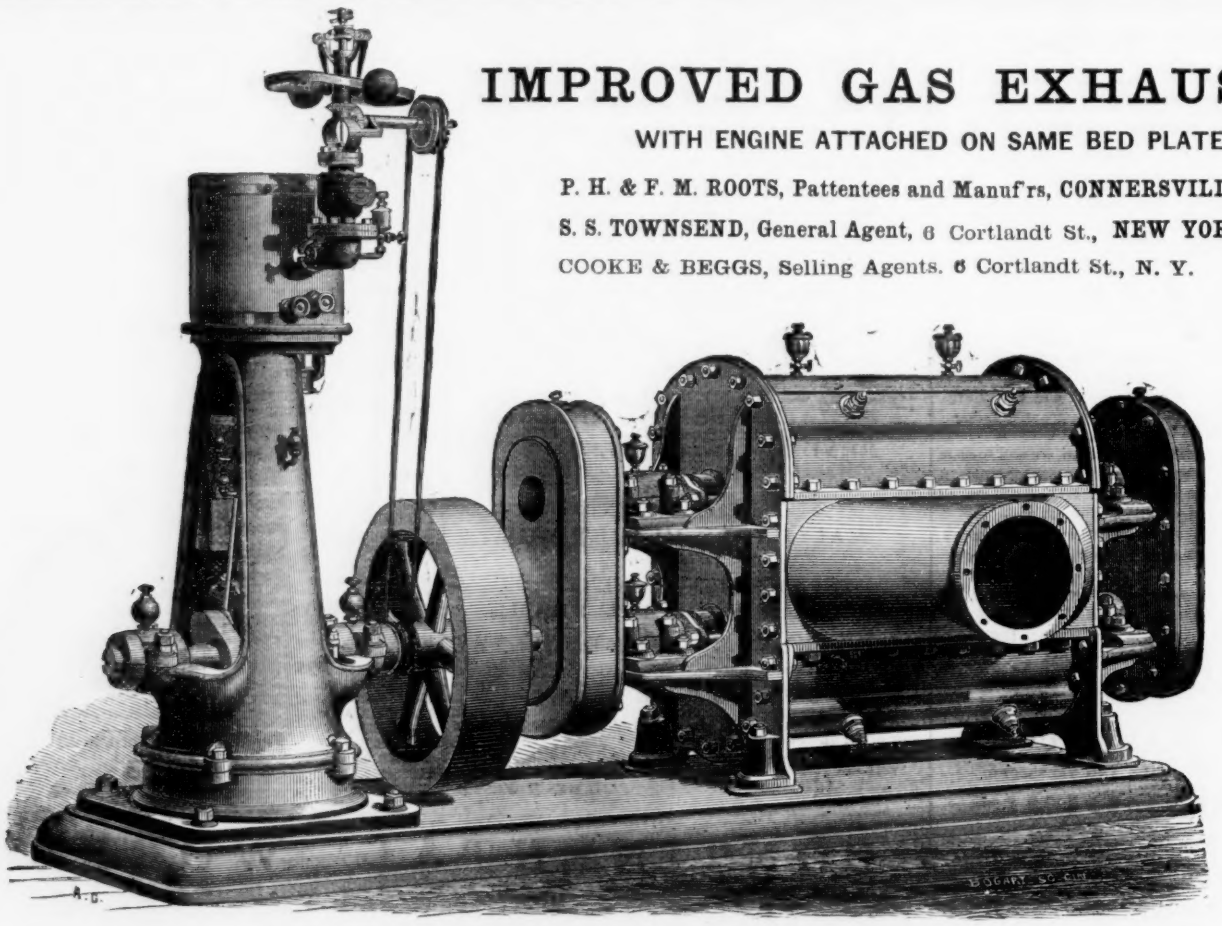

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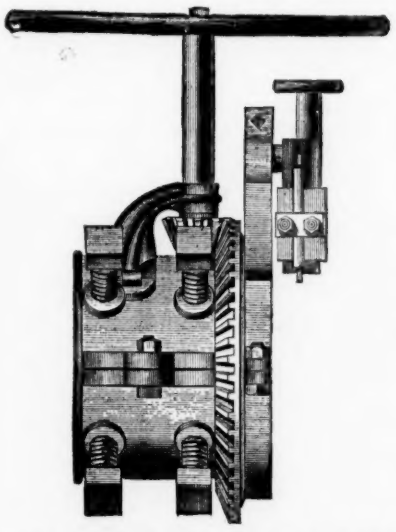

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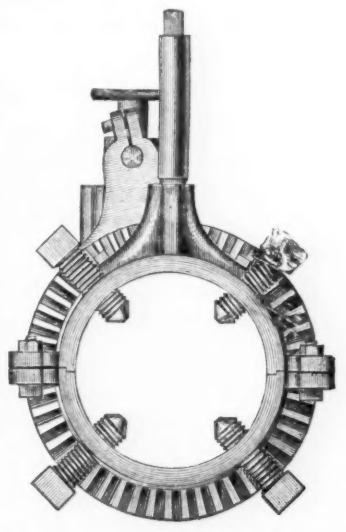

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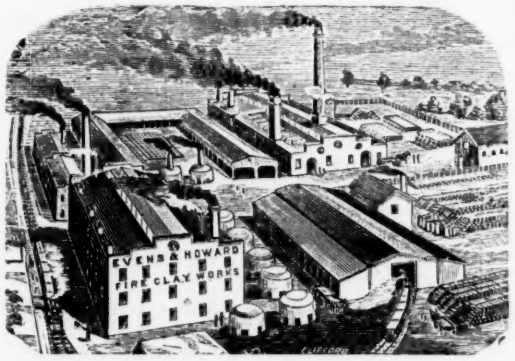

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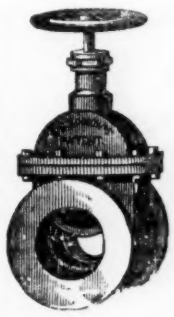

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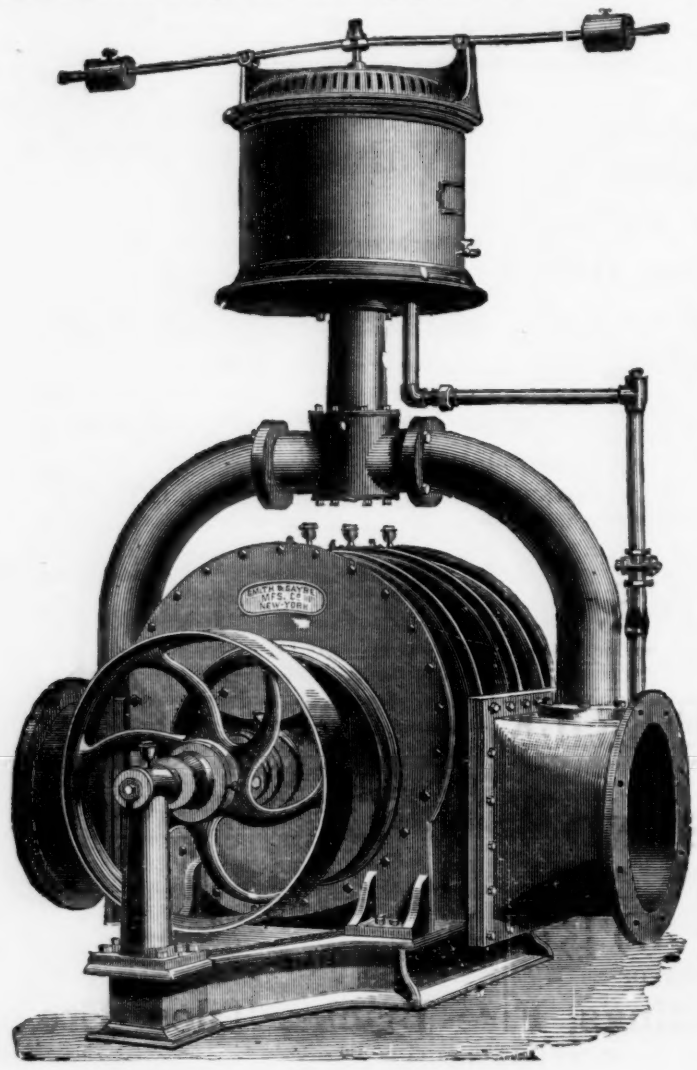

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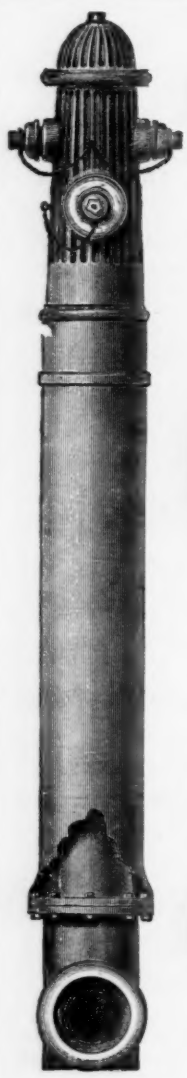

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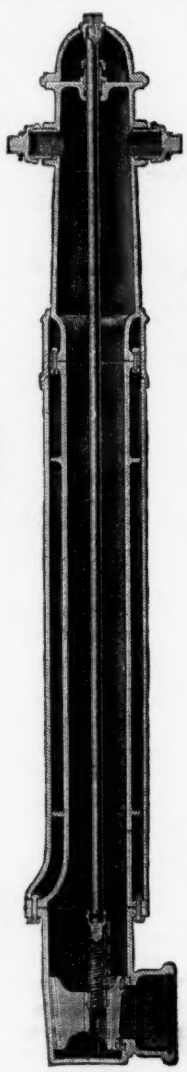

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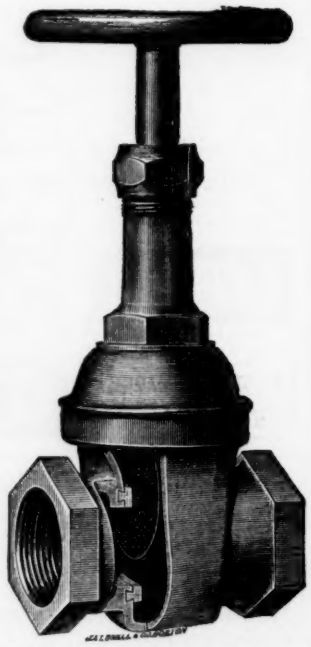
Great Falls Gas-Light Company,	N. H.
St. Albans Gas-Light Company,	Vt.
Louisville Gas-Light Company,	Louisville, Ky.
Cincinnati Gas-Light Company,	Cincinnati, O.
People's Gas-Light Company,	Brooklyn, N.Y.
Citizen's Gas-Light Company,	" "
Williamsburg Gas-Light Co.	" "
Brooklyn Gas-Light Company,	"
Citizens' Gas-Light Company,	Newark, N.J.
Peoria Gas-Light Company,	Peoria, Ill.



Office and Salesroom, 77 KILBY STREET, BOSTON. Works at INDIAN ORCHARD, MASS.